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TWO FOLDING ARM CHAIRS.

BY JAMES SCOTT.

THERE are to be found among that mysterious community called the Public certain persons who declare that they really detest such things as folding chairs. If, however, the truth could be extracted from them, I think it would be found that the true reason is not because they *are* folding chairs, but because they always have a nasty habit of squeaking when being sat upon.

Now, in the sketches here shown are two folding chairs which will not be so liable to give way to this objectionable habit, as I have designed them to work upon hinges; and the bending of these will not create so much noise as wooden connections do. There is nothing particularly new in the patterns of these two arm chairs; the originality consists in their method of folding.

Dealing with Fig. 1, I will give what I consider the most accommodating sizes; it must be remembered, however, that if made for personal use, dimensions should be studied a little, and altered accordingly. The height from the floor to the seat is 16 in.; length from the back to front of seat, 18 in.; width of seat, 20 in.; height of back from seat, 22 in.

The back should be prepared first, and should be the same width from top to bottom. The seat is next made in two pieces, one piece to fit between the two back feet, and the other forming the seat proper; these are securely hinged to each other. Each arm is in one piece with each front foot, the shaping of which will be the most difficult part; but as it is not my purpose here to give instructions on wood working, I shall presume that my readers can handle a few tools skilfully. The arms can be of any size, but whatever they are, it must be borne in mind that each will have to be a quarter of a circle in shape. If they are 12 in. distance from the back, they will have to be cut out of a circle 24 in. in diameter: and if at 15 in. from the back, the circle from which they must be cut will be 30 in. in diameter; these are outside measurements. Whatever the dimensions of these arms may be, a piece must be cut out of the seat on each side to admit them; and it is by this means that the seat is enabled to rise up against the back. The arms also have to be made to fold one over the other. This is effected by cutting one arm through at 1 in. distance from the back, and the other at 2 in., and hinging them. Fig. 2 shows the appearance of the chair when folded.

Fig. 2.

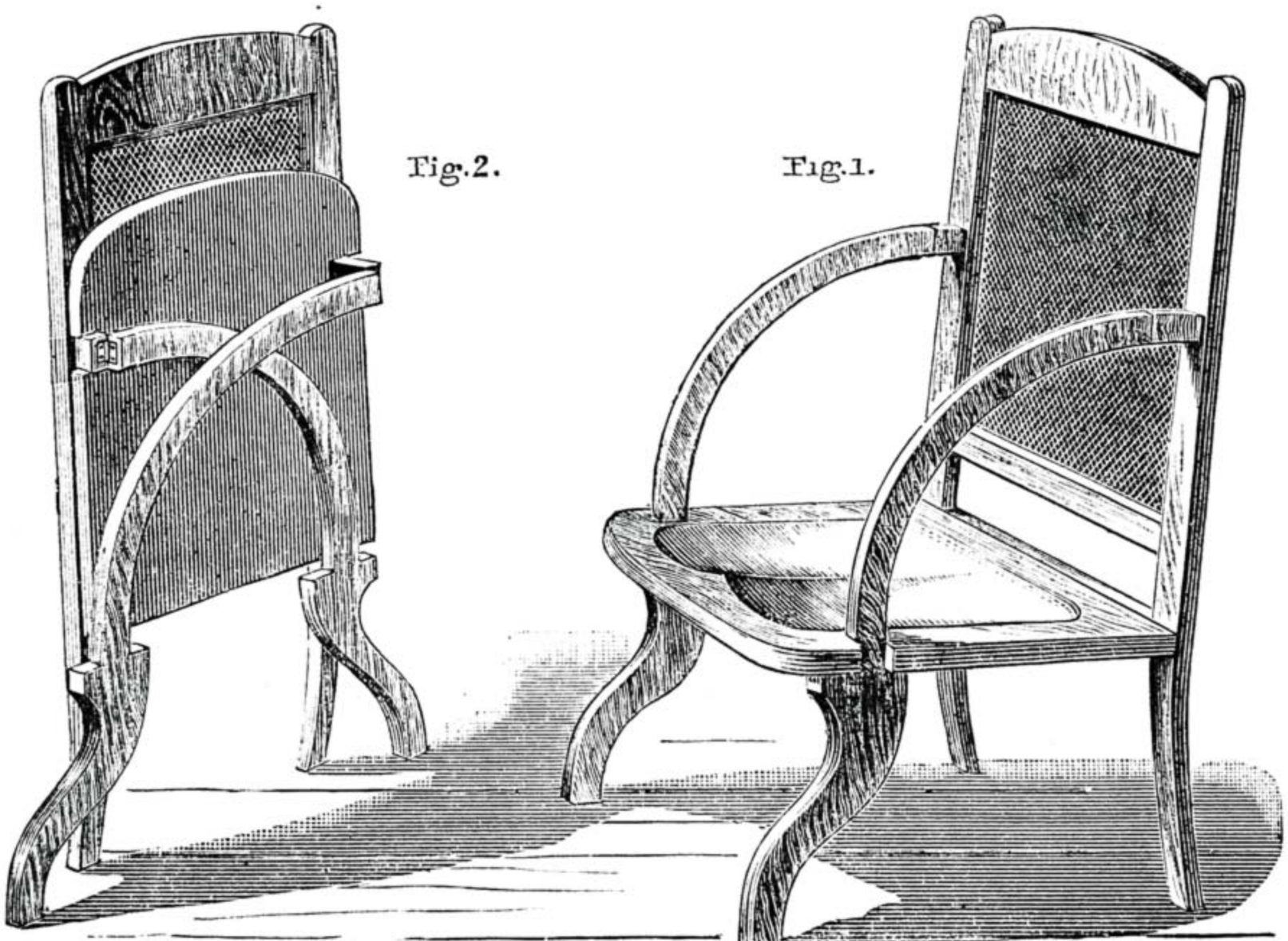

Fig. 1.

Fig. 3

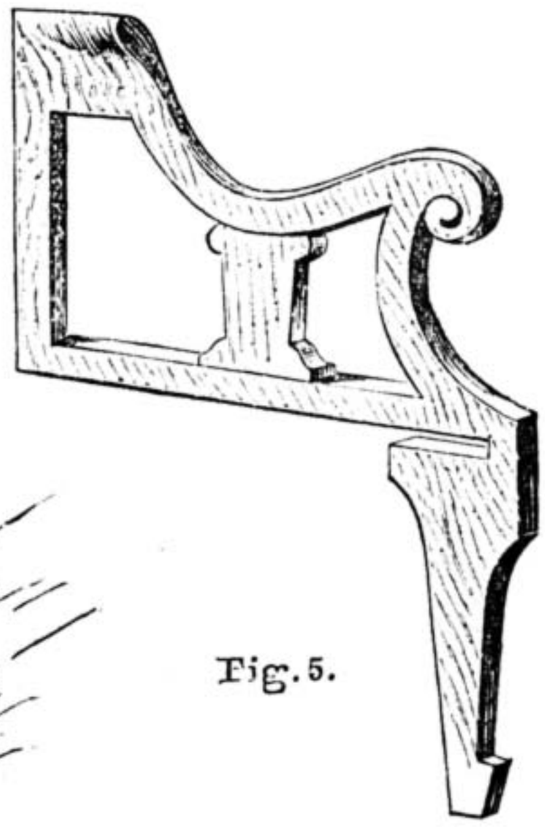

Fig. 5.

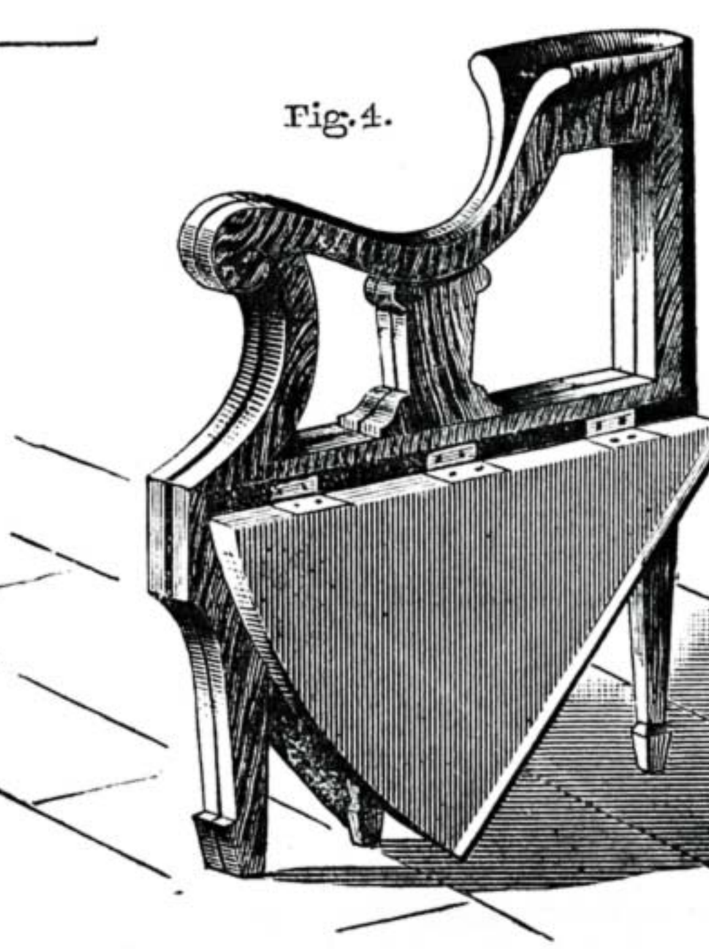

Fig. 4.

FOLDING ARM CHAIRS. Fig. 1.—Square Arm Chair expanded. Fig. 2.—Square Arm Chair folded. Fig. 3.—Corner Arm Chair expanded. Fig. 4.—Corner Arm Chair folded. Fig. 5.—Shape of Arm of Corner Chair shown in Figs. 3 and 4.

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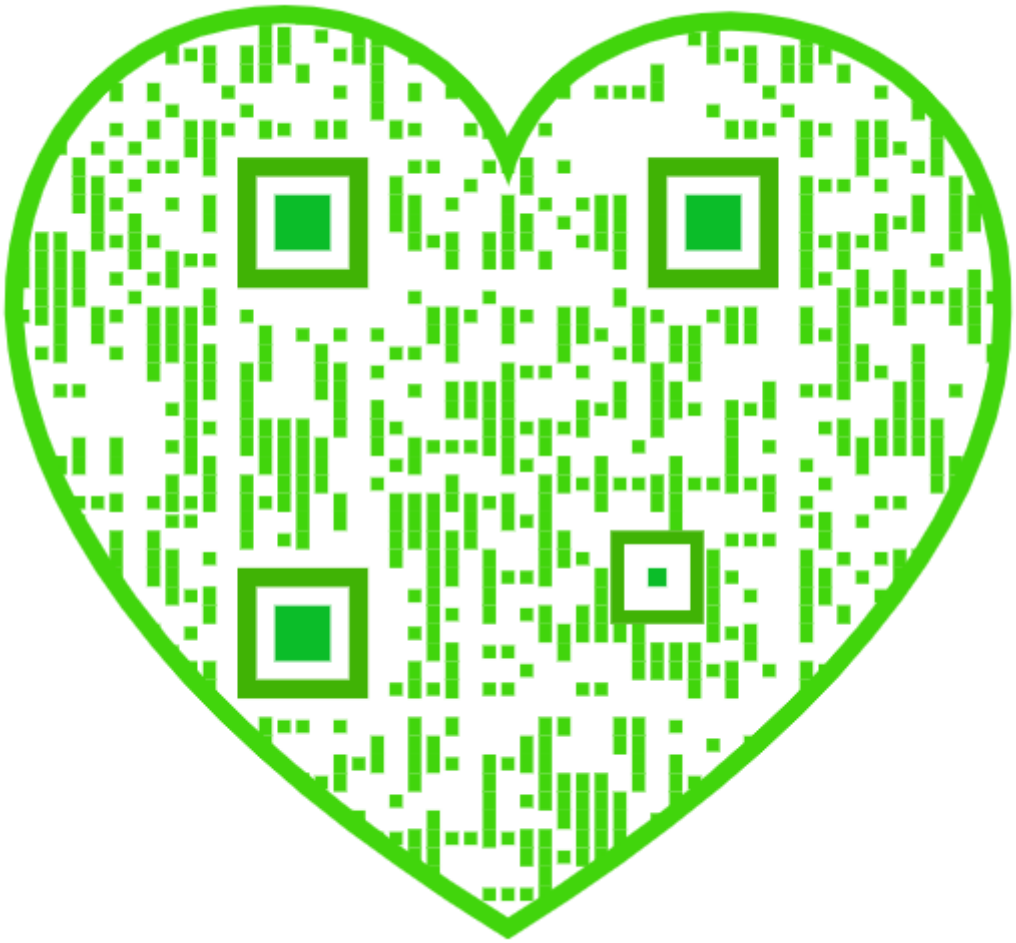

Fig. 3 has somewhat the look of what is termed a corner chair. A very comfortable chair can be made by following the design. As with Fig. 1, I will give the most appropriate sizes. The height from floor to seat is 16 in.; height of back from seat, 16 in.; height of arms, 9 in.; seat, from back to front, 18 in.

The seat should be made first, and must be some part of a circle. A circle should be drawn on the board to be used, and the size considered best marked off, from the centre to the outside, and cut out. A piece about 2 in. wide should then be cut out along the middle of the seat, making the seat into three pieces. The two larger parts are then hinged, one on each side, to the middle piece.

Underneath the middle piece, and a few inches from the centre of it, should be fitted a leg. A back-foot, in length from the floor to the top of the back, should also be joined into it. It should be fitted so that the ends of the arm pieces may close nicely against it when they are hinged. The length from back to front of these arms will be just a little more than that of the seat. Fig. 5 shows how they should be made.

At each end of the seat should be a rim, to prevent the arms from slipping off.

The banister under each arm is entirely a matter of choice. These chairs should be made in one of the hard woods, and polished; and if the hinges are in good working order, and strong, and are properly fitted, no complaint will be made of the chairs squeaking.

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

Stringing, Tension, Pitch, and Chipping Up.

The pianos of to-day are strung much heavier than they were formerly, and consequently the back is made stronger to resist the greater tension of the strings. If I may say so, it has been a battle between the strength of the back and the tension of the strings. If the piano has to stand well in tune, of course the back must be the stronger. If one of the old pianos were strung with the wire we now use, it would simply collapse. The theory of stringing requires that each octave, starting from the treble, should double its length, but if that were carried out in the piano under our consideration, we should have a 16-ft. string for the lowest C. Of course, that is impossible in a cottage piano, so the difficulty is surmounted by increasing the thickness of the wire and obtaining lower notes. When a string is struck with the hammer in the piano, it causes it to vibrate a given number of times according to its length and tension, the higher the note, the greater number of times it vibrates. It is said by writers on acoustics that sonorous vibrations lie between 16 and 38,000 per second of time. This seems a large number of vibrations in so short a space of time, but it can be proved by at least six different methods. In a 7-octave pianoforte, the extreme bass A corresponds to about 27 vibrations, and the extreme treble A to 3,480 vibrations per second. The theoretical pitch, as it is termed, is the pitch accepted by acousticians as the natural one, being 512 vibrations per second for pitch C, each octave lower decreasing by half: thus, 512, 256, 128, 64, 32, and each octave higher increasing by double the number in a second. The fork by which pianos are usually tuned is of a higher pitch than this, giving 519 vibrations per second, and called the philharmonic. Some use a higher pitch still, called the diapason normal, giving 522 vibrations per second.

Before commencing to string the instrument, take a strip of cloth listing (such as tailors cut off the edges of their cloth) and glue on the top of slip, which is round the bent side, and also glue a strip on the top edge of bottom plate; this is for the strings to lie on to prevent jarring. Now take a pen and ink and mark the gamut over each note, commencing with A at the bass end, and marking it the same as the marking off slip. The treble and tenor notes of the piano are strung with steel wire, and the bass notes are steel with copper wire wound round them. The steel wire and the bass strings can be had from the ironmonger before mentioned. Now mark under the notes the sizes of your wire, count 6 notes from the treble and mark 13, and then mark again in the following order:—10 notes of 14 wire, 6 notes of 15, 6 notes of 16, 21 notes of 17, 3 notes of 18, 2 notes of 19, 2 notes of 20, 1 note of 21. You will require a ¼ lb. of all these sizes, with the exception of 17; of this you will require ¾ lb. Now you will require to take a scale from your back for the covered bass strings; this you do with a sheet of newspaper. Lay it on the back so that it covers the short bridge in its width from the bass end, and is over the top bridge and the bottom plate; now take your heel-ball and rub over the pins gently on your top bridge, short bridge, and bottom plate; this will give the size for the string-maker.

When ordering your strings, say you want them about 4 lbs. weight. You may now commence to string your back; see that it is laid evenly on your trestles, one under your wrest plank, and the other under the bottom. You will require a tuning-hammer to turn the pins, also a pair of pliers to cut the steel wire. The best place to obtain these or any tool for pianoforte making is at Buck's, Tottenham Court Road, W.C. You will also have to use a hammer to drive in the pins. As you will know by marking the wrest plank, you start at the treble end with No. 13 wire, the first 22 notes being trichord. Your centre string will need a loop on the end; this is looped on the front row of pins. Take your wire, and having put a piece of wire of the thickness of the hitch pin in your bench vice, hold the end of it with your pliers, and give it a couple of turns round the wire, and then slip it off the wire, and while holding the loop thus made, finish it off by turning the short end round it. Now put your loop on the first pin in the front row on the bent side, pull it tight with your pliers, carry it over the bridges, and three inches over the hole where you require the pin, if you make a mark with a file or your pliers three inches from the point, you can measure your wire to this mark. Having cut your wire, put the end in the hole in your wrest pin and turn the pin round to the right until the wire is coiled round it two or three times; then drive the pin into the wrest plank with your hammer until the coil is a quarter of an inch from the plank, then tighten it by turning to the right; now put the end of your wire in a wrest pin and repeat the operation of coiling. Drive this pin into the first hole in your wrest plank, and take the wire round the first pin in the second row in the bent side and over the bridges; cut off and put round a wrest pin, and drive it in your third hole of the wrest plank; this will complete one note. The remainder are done in the same way until you get to the bichord; of course the middle string is left out. Take care the sizes are put on as you marked them on the plank; the sizes will be marked on the paper the wire is wrapped in.

When you have got all the steel wire on, then put on the covered bass strings; these you will find are threaded on a wire, with loops on the ends. Take off one note of two strings from the end where they are the thinnest; put the two loops together, and the one that is farthest away from the copper put on the bottom pin on the plate; carry over bridges, and pin the same as before. Take care to take them off the wire in rotation, as they are not all the same size; of course, the last seven are single; these are thicker than the others, being double-covered with copper. Now you must run a piece of listing in and out of the strings below the bridges, and a piece of red cloth or braid over the top bridge. This is done to damp the sound in all parts except between the bridges. You can now stand the back on its bottom, leaning against the wall, and see that the coils are all nice and even round the pins; if not to your satisfaction, you can draw them close by slacking a little with your tuning-hammer, and drawing up with a button-hook. Now the maker, no doubt, would wish to hear the tone of his instrument, but of course he can only do this in a small measure until the hammers are in.

There is an operation which is called chipping up. This is really giving the piano its first rough tuning. You will want a C tuning-fork: this gives the note for pitch C. It is the third C from the treble end. Put your tuning-hammer on the treble pin of your note, strike the prongs of your fork, then place the end on your back. When it gives the note, pull up your string until it sounds the same as your fork; when you can hear the two sounding together as one note, that is right or in unison with the fork; but if it is not right, you will hear what are called beats, which I can only describe by saying they sound like "Woo, woo, woo;" the more it is out of tune the quicker will you hear the beats; you must tune until the beats cease, and sound like one note. Having got this right with the fork, you chip the other string of your note with a small piece of brass until it is in unison with the string you pulled up to the fork. Now you pull up your C below the pitch C; this is an octave below; when this is in tune and both C's are chipped, it will sound like one note, and very agreeable to the ear. Now pull up the G below; this is called a fourth; you can hear when the beats cease. Now pull up the D above; this is called a fifth, chipping the two notes together; then from D to A below, then A to E above, then E to B below, then B to F sharp; then get the octave F sharp below; then from F sharp to C sharp above, C sharp to G sharp below, G sharp to D sharp above, D sharp to A sharp below, then C to F below. Try the following chords G C E when you have tuned the E; G B D after tuning B; A D F sharp after tuning F sharp; and F A C after tuning F. If the reader has a musical ear and some perseverance, no doubt he will be able to master it. This is called the scale, being the basis from which the piano is tuned. There is a small instrument sold at music shops called the chromatic pitch-pipe; by moving a slide it gives all the notes in the chromatic scale. This would be found a great help to beginners in tuning. When you have chipped up the scale, you can go on with the octaves above; your

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first note to pull up will be F below pitch C, to be pulled up an octave higher than the F below it, and so you can take each succeeding note until you have done the treble, then you tune the octaves below your scale, your first note to tune being E, going down to the bass. I need scarcely tell you that an octave would be from doh to doh, running up the scale or down. This having been done, you take a piece of hard wood with a slight groove in the end, and press all the steel strings singly, and pull out the copper strings. This is done to stretch the strings so that they stand in tune. Now you can chip it up again, repeating this operation several times at convenient opportunities, remembering that you are doing the instrument good (if you do not work the pin backwards so as to make it loose) and improving your ear. If you pull a note a shade too sharp, it is better to press it down. I may say you must keep the back in a dry place after it is strung to prevent rust. This completes the operation of stringing.

BRONZE AND BRONZING.

BY GEORGE EDWINSON BONNEY.

BRONZE—BRONZE PICKLES—BRONZING—BRONZING ELECTRO-BRASSED WORK—WARM BRONZE—BLACK BRONZE — STEEL BRONZE — GREEN BRONZE—GREEN ANTIQUE BRONZE.

Bronze.—Bronze is an alloy composed of copper, zinc, and tin in various proportions. When other metals are associated with copper to form a bronze-like alloy, a prefix is added to the word, and thus indicates the composition of the alloy. These alloys are found to possess characteristic properties quite distinct from those of ordinary bronze; not the least important differences to the electro-plater being those relating to their conductivity and resistance. Aluminium bronze, for instance (composed of copper 90 parts, and aluminium 10 parts), has a conductivity as compared with pure copper, represented by 12·6 to 100. Silicium bronze, composed of copper with a small percentage of silicon, as used for telegraph wires, has a relative conductivity of 98, whilst a larger percentage of silicon (in an alloy used for telephonic wires) pulls down the conductivity to 35. Phosphor bronze (as used for telephone wires) is composed of copper alloyed with a small quantity of phosphorus, and its relative conductivity is 29, whilst phosphor bronze, with 10 per cent. of tin, has only a relative conductivity of 6·5. An ordinary bronze, such as used in light castings, composed of copper 80 per cent. and tin 20 per cent., has a relative conductivity of 8·4. The following table will show at a glance the composition of some of the more common kinds of bronze.

TABLE OF BRONZE ALLOYS.

Name.	Copper.	Tin.	Zinc.
Coinage bronze	95·	4·	1
Pale bell metal..	96·	4·	0
Common bronze , ...	94·3	5·7	0
Do. do.	91·5	8·5	0
Gun metal	90·	10·	0
Bell metal	79·	21·	0
Gong metal	78·	22·	0
Speculum metal	68·5	31·5	0

There are several other modifications of bronze used for particular purposes, but it is not desirable to examine them in these notes, nor to go thoroughly into the metallurgy of brass and bronze. Enough has been written to show the plater that both alloys differ very much in their composition when made for various purposes, and these differences may affect the deposition of metals upon them, on account of the varying resistances of the alloys themselves. These remarks apply particularly to the choice of a brass or a bronze to be used as an anode in the operations of brassing and bronzing.

Bronze Pickles.—Bronze may be pickled in any of the "acid dips" used for cleaning brass, but preference should be given to those which do not contain strong nitric acid in a large quantity, since the tin of the alloy does not form a soluble salt with this acid. The addition of some hydrochloric acid will assist the action of the pickle on bronze. (See *Brass Pickles*, page 597.)

Bronzing.—This term is generally applied to processes for giving a so-called bronze appearance to brass and copper. The electro deposition of bronze itself is rarely practised, since most brassing solutions can be made to yield a deposit resembling real bronze in tint, by merely increasing the quantity of copper in the deposit. Bronze solutions are made up in a similar manner and of similar ingredients to those used in brass solutions, the only difference being the substitution of chloride of tin for the sulphate of zinc used in those solutions. They are also worked in a similar manner, but the density of the current must be regulated to meet the higher electrical equivalent of tin—viz., 59, as against 32·6 of zinc; since 33·5 grains of tin will be deposited in an hour by the same current that will deposit only 18·5 grains of zinc. For further information, see note on *Brassing* and Mr. J. T. Sprague's remarks on the deposition of alloys.

Bronzing Electro-Brassed Work.—When it is intended to impart an ornamental effect to electro-brassed work by means of certain stains and varnishes, the process is termed "bronzing." The effects named below are produced as follows:—

Warm Bronze.—When a warm bronze or chocolate tint is desired on brass, it should be painted with a mixture composed of blacklead, 1 oz.; Sienna powder, 2 oz.; rouge, ½ oz.; made into a paste with a little water, to which has been added a few drops of sulphide of ammonium, or of chloride of platinum solution. The proportions of the various ingredients may be varied to suit the taste of the artist, just as he may desire to have a dark or a ruddy tone on the brass.

Black Bronze effects are produced by painting the brass with chloride of platinum dissolved in spirits of wine; or a mixture of blacklead with the chloride of platinum solution; or the same ingredient made into a paste with sulphide of ammonium solution. Mr. Watt prefers the platinum solution, because it produces a more brilliant and lasting effect.

Steel Bronze effects are produced by slightly heating the articles after being painted with the chloride of platinum solution used for black bronze.

Green Bronze.—A mixture for producing green bronze tints on electro-brassed work, is composed of chromate of lead (chrome yellow), 2 oz.; Prussian blue, 2 oz.; plumbago, ½ lb.; Sienna powder, ¼ lb.; lac carmine, ¼ lb.; made into a paste with water containing a small quantity of sulphide of ammonium, or of chloride of platinum.

Green Antique Bronze.—These effects may be produced by smearing the brassed articles with a mixture composed of acetate of copper, 10 parts; cream of tartar, 10 parts; common salt, 10 parts; carbonate of ammonia, or muriate of ammonia, 30 parts; dissolved in 100 parts of acetic acid, or in 200 parts of good vinegar. To this add a little water and mix well. The parts painted with this mixture must be allowed to dry at an ordinary temperature, and at the end of some twenty-four or forty-eight hours will be found to be covered with a green verdigris. This must be brushed with a soft brush previously rubbed on a lump of beeswax. A blue shade may be given to parts of the work by touching them with a little dilute ammonia liquor, and the green tints may be deepened by touching them with a solution of ammonia carbonate. As the dry powder brushed off from this dried bronzing mixture is poisonous, the workman should wear a piece of muslin over the mouth and nostrils whilst polishing work that has been coated with bronzing powders. The first four mixtures mentioned above should be polished with a soft long-haired brush when nearly dry. If it is desired to show the brass in parts, these may be touched up afterwards with a piece of chamois leather dipped in spirits of wine and rubbed on a lump of chalk or whiting. When finished, the work may be made moderately warm and varnished thinly with a quick-drying hard varnish.

PANELS IN GESSO WORK.

BY E. C.

PANELS may be put to so many uses that amateurs can hardly do better than decorate some for the sake of practice. Few persons, especially non-professionals, care to throw aside all their early attempts in any art-work. Unless, as students, they are resolved to go thoroughly in for any particular branch of art, when their work for a time consists of "studies" only, they prefer to utilise, as far as possible, all they do. And, indeed, the gesso worker who has a fair knowledge of drawing and painting already, will be unlikely to fail, even in his earliest productions.

Still, the panel is advisable to commence on. It is not heart-rending if it does not prove altogether presentable when finished; it is, or may be, small, and so takes little time to decorate; whilst the problem where to place it if the decoration is satisfactory is easily solved.

Here are a few positions which a panel decorated in gesso will fill with advantage: it will greatly improve the appearance of a door of a cabinet, and, if small borders are added about an inch or so beyond the outer edge of the panel, leaving a narrow band of plain wood between, the richness of effect will be enhanced. Naturally the design of the borders must be in keeping with the centre piece, and the separation will be increased or diminished according to the size of door. A bracket cupboard used for medicine or for books will be far more attractive if a well-executed "gessoed" panel is introduced in the door in place of the plain or commonly carved one often seen in these useful articles.

Some very inexpensive standing corner cupboards are to be bought now made of plain wood, and ready for staining or enamelling. The adaptation of an artistically designed panel would be the making of one of these, and turn it into an object worthy to figure in a handsomely furnished

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room. It will possess an interest through being the work of the owner that it could never have if merely purchased complete for use; but, then, the panel must be well done, or I, for one, would infinitely prefer that it should remain without ornamentation of any kind. Then there is the mahogany coal box with its sloping door, that might well be beautified by a good design in gesso; the fire-screen, with its one, two, or three panels; the flower-stand with panels in lieu of tiles; the fancy ebonised writing table, that might have a long narrow panel extending across the upright back, and the drawers enriched with delicate diaper patterns. And when a high standard is reached, the artist may execute panels bearing figure subjects that will be of sufficient interest to frame and hang on a wall. For there are pictorial effects to be secured of no mean worth by clever gesso workers.

I will now suggest two or three styles in which the accompanying illustrations can be carried out. Fig. 1 shows how gesso work can be employed with charming results for the decoration of a fire-screen. If we have a fancy for producing something uncommon, here is a fine opportunity. The framework of the screen is of white enamelled wood, and the carved mount of the gesso panels stained rosewood or mahogany. The combination of white enamel and mahogany will be found extremely pleasing; it is seldom seen, though now and again first-class decorators indulge in its use. Perhaps its rarity is in some respects a good thing, for unless due regard is taken of its surroundings, it may prove anything but attractive. As a foil to gesso work it is admirable.

Fig. 1.—Fire-Screen, Central Panel in Gesso Work, set in Carved Frame.

The whole of the panel should be laid with gesso, then the figure, birds, and foliage carefully modelled, the highest relief being reserved for the figure. The latter requires the greatest care, for by the manner in which it is rendered the skill of the artist will be judged. Colour may hide a multitude of sins, but cannot atone for inaccurate modelling. When the gesso is ready for tinting the figure may be treated first, though it is well not to finish it entirely until the foliage is somewhat advanced, as the tints react on one another, and we cannot produce a perfect harmony unless we work up all the subject gradually. In a replica we can, of course, follow either plan. The first scheme of colour I propose is white, green, and gold, with touches of copper red. The drapery is white with soft reflections shown in the folds, the foliage a delicate green veined with gold; in the fruit and in the pot the touches of copper red are introduced; whilst the plumage of the birds is given in tints of gold with copper red. The ground is of gold, pure and simple, without a hint of copper.

It must be remembered that gesso work is in its essence a decorative art, and we must not attempt to portray naturalistic effects; in the colouring we should fail utterly were we to try to follow Nature servilely. A conventional decoration is what we should aim at if we wish to be successful.

Now for the second suggestion for Fig. 1, which I must give briefly: For the drapery use the beautiful copper red tint; for the foliage, emerald veined with gold; repeat the copper red in a modified tint in the pot, fruit, and birds, or let the foliage be rendered in copper and the pot and birds in a bluish purple tint; and, lastly, gild the background.

For Fig. 2 I should recommend that the dragons be wrought out in gold, the wings commencing with blue that is presently lost in purple, and continued in gold and copper; the ground in silver. In modelling the wings of the dragons cotton-wool will be found to produce a delicate cobwebby texture that is wonderfully effective, and I cannot too strongly advise the worker to try it. There probably will be a little difficulty experienced in manipulating it at first, but the greater the credit when success is attained, and patient endeavour is never thrown away. We *must* succeed if we resolve to do so.

That the student may acquire the habit of working in different styles, he should practise ornamenting stained and polished wood. In this decoration I would have the relief lower than in the last mentioned, and the painting principally relied on for attaining an effective piece of gesso work. The amateur worker on making his or her first essay in gesso work may not be pleased with the effect produced. This, however, is the natural outcome of want of experience and lack of practice. I am sure that a little steady, painstaking, conscientious work will give better and better results, and eventually cause considerable pleasure in following up this branch of decorative art.

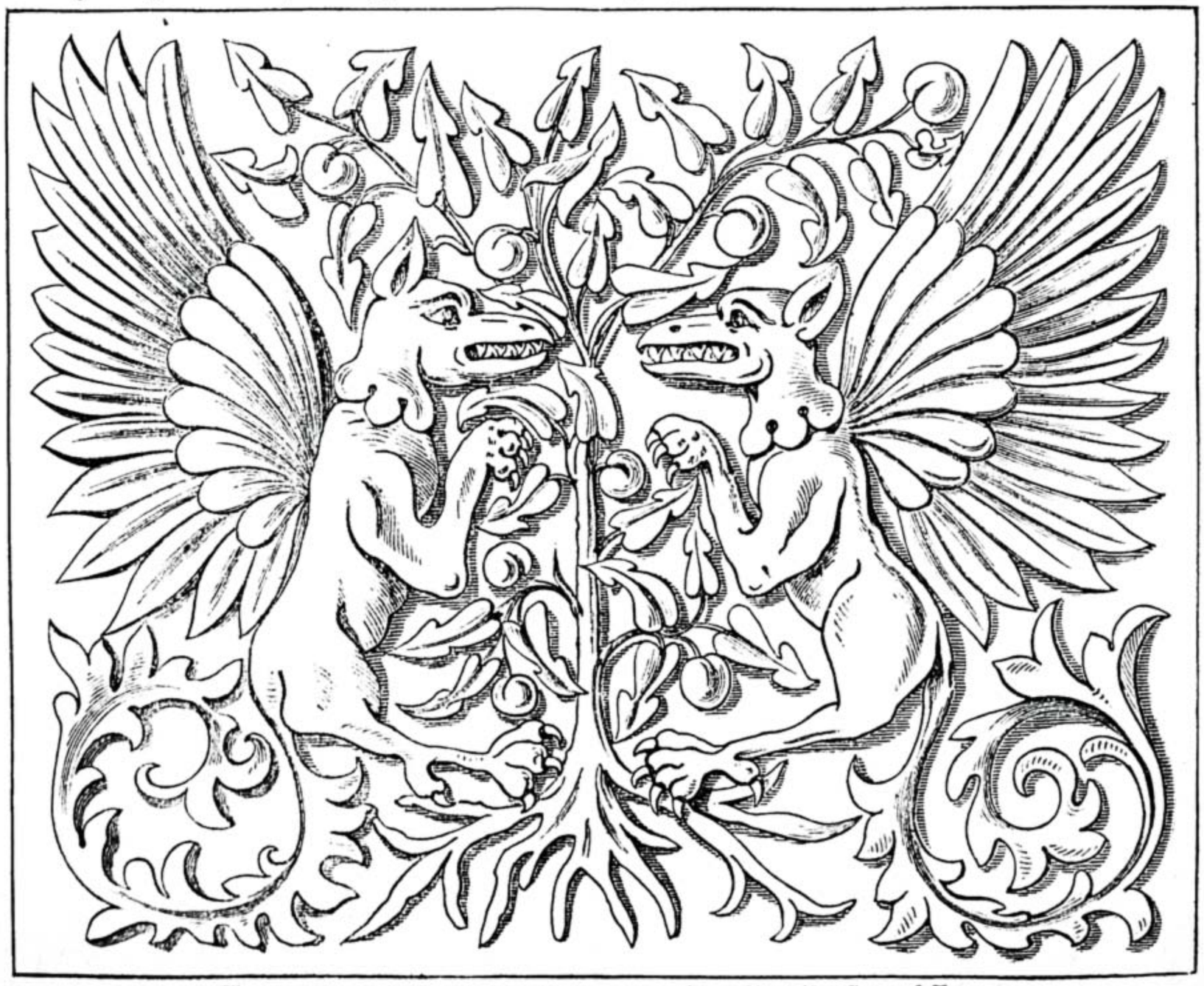

Fig. 2.—Panel in Gesso Work: Dragons Guarding the Sacred Tree.

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THE DULCIMER, AND HOW TO BUILD ONE.

BY R. F.

VENEERING, VARNISHING, STRINGING, AND TUNING.

THE back facing having been fitted, the moulding has to be placed round the belly. The best kind of moulding to use for this purpose is a plain one, which can easily be made by taking a piece of 1 in. stuff and making a half-round bead, which is then cut off and divided down the centre (Fig. 15). When your moulding is ready, fit it carefully into its place, commencing with the longest side, and glue and fasten it down with $\frac{7}{8}$ in. brads—of course, taking care to bore the holes for the brads first.

Now we are ready for the veneering. Procure a piece of mahogany, walnut, or any other veneer that suits your fancy, and cut strips rather longer and wider than the facings of your instrument, and, having gone over the facings with a toothing plane (first noting that the screws are well below the surface), glue on with the best glue, and, squeezing and pressing out as much of the glue as possible, weight down, and allow to dry. When dry, the top edges may be veneered, and, after allowing another interval to elapse, may be cleaned off and gone over with a scraper. We have now a most important part of the work before us, viz., the "setting out" of the blocks for the "wrest" and "hitch-pins." Four lines, at distances of $\frac{1}{2}$ in. from each other, must be drawn from top to bottom of the centre of each block, and on the front, or inner, line of the right-hand block, at a distance of 2 in. from the front, make a dot, and another dot on the same line, at a distance of $1\frac{1}{2}$ in. from the back edge. Now divide the distance between these two into exactly nineteen spaces (twenty dots in all); $\frac{1}{8}$ in. higher on line No. 2 commence another series, and the same with Nos. 3 and 4. The hitch-pin block is marked in the same manner, but in the reverse order, the lowest dot coming on the *outside* line (Fig. 9).

The next operation is that of polishing or varnishing. I prefer polishing, as it stands better, and gives a brighter finish; but, if it is intended to varnish, first go over the belly carefully with Stephens' Ebony Stain, taking care not to come above the level of the blocks. Stain also inside the sound-holes as far as you can, and also the *back* of the blocks, and for about an inch round the outer edge of the back itself. When dry, if the colour is satisfactory, give a coat all over with size, made of glue one part, *warm* water six parts, and, when this is firmly set, varnish with good copal, which must be very lightly and evenly applied; and then the instrument may be set on one side for a few days for the varnish to get thoroughly set and hard.

While all these drying operations are going on, opportunities are afforded for getting out the wrest-pins, the hitch-pins, the bridges, the sound-hole frets or rings, the feet, and the stand; and here I may as well say that all these are better and cheaper bought ready-made, as they take some amount of time and patience in preparing. Messrs. Chilvers & Co., St. Stephen's, Norwich, supply every requisite at a very cheap rate. But we will suppose that you have both these indispensables at command; very well, commence then with the wrest-pins. Of these, eighty will be required. Get a piece of No. 6 B.W.G.—by-the-bye, this means Birmingham Wire Gauge—iron wire of the necessary length—that is, about 12 ft.—and cut it into $1\frac{3}{4}$ in. lengths, either with a hard chisel and hammer, with a hack-saw, or the sharp edge of a half-round file. Round up the top and bottom of these lengths, and file one end taper on both sides for about $\frac{1}{2}$ in. down. At the bottom of the taper thus formed, drill a small hole to receive the end of the string. Thread these pins on a piece of wire, and stretch it between two points, and black them for about half their length with Brunswick black, and the pin is complete (Fig. 8). The greatest difficulty will be in drilling the holes, and, if this is beyond you, a simpler plan can be adopted by using loops of thread, which method I will explain when we come to the stringing. The sound-hole frets are simply ornamental rings turned to fit the sound-holes, but are very often filled in with fretwork, carved work, inlaid stars, or other designs. The bridges (Fig. 11) are made of beech, turned as shown, and cut on the dotted lines with a chisel. Across the edge thus formed a V-shaped groove is made to take a piece of brass wire for the strings to pass over. These bridges may be either varnished in the natural colour, bronzed, or gilded. The feet are four flat balls of 1 in. diameter and $\frac{3}{4}$ in. thick, and are screwed on one at each corner of the back, after it has been covered with blue or other coloured paper. The stand is made of $\frac{3}{8}$ in. stuff, veneered on both sides *diagonally*, so that the grain of one side crosses that of the other, and both run in a different direction to that of the wood. The stand is 9 in. long and 5 in. high, and may be shaped to fancy; that usually adopted is shown at Fig. 10. This is screwed on to the back with a pair of 1 in. butts, at a distance of 2 in. from the back edge. Two pieces of brass wire, $\frac{1}{8}$ in. diameter, will be wanted for the grooves in the blocks, and about 2 ft. of No. 18 brass for the tops of the bridges. Also get a yard of velvet ribbon, about $\frac{1}{4}$ in. wide, for the block dampers. Cut off your brass wire to exactly the length of the grooves in the blocks, round up the ends, and polish them. *Outside* these fasten lightly with small tacks strips of your ribbon, one on each block. Cut off forty pieces of the No. 18 brass wire; file the ends level and to fit the tops of bridges. Fit and glue in your sound-hole frets or rings, and proceed to ornament the belly. This so obviously depends upon your own taste and style that I need hardly say a word about it, except that you must be sure that the varnish is *perfectly* dry and hard, not in the *slightest* degree tacky, or your gold leaf or bronze powder will assuredly stick where most you *don't* want it. But stop! I am

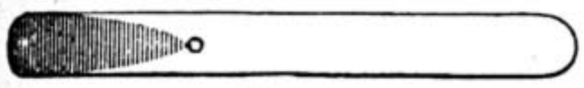
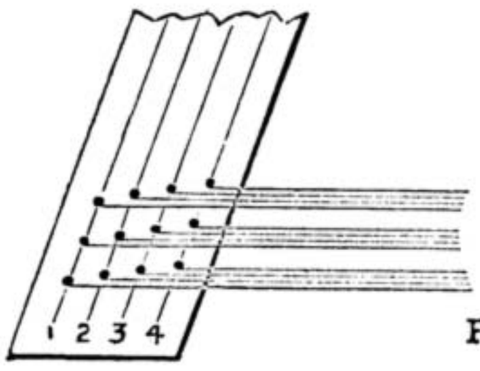


Fig. 8.



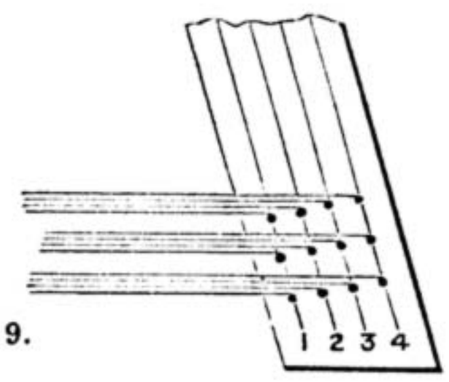


Fig. 9.

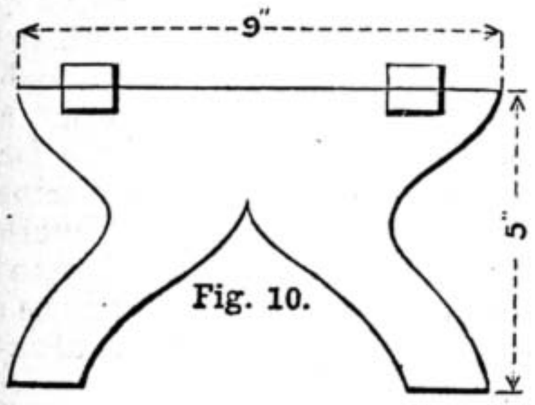


Fig. 10.

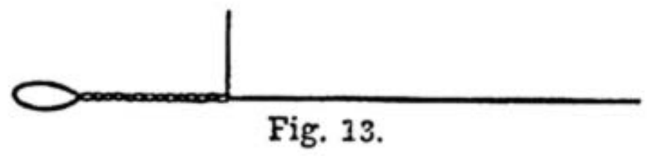


Fig. 13.

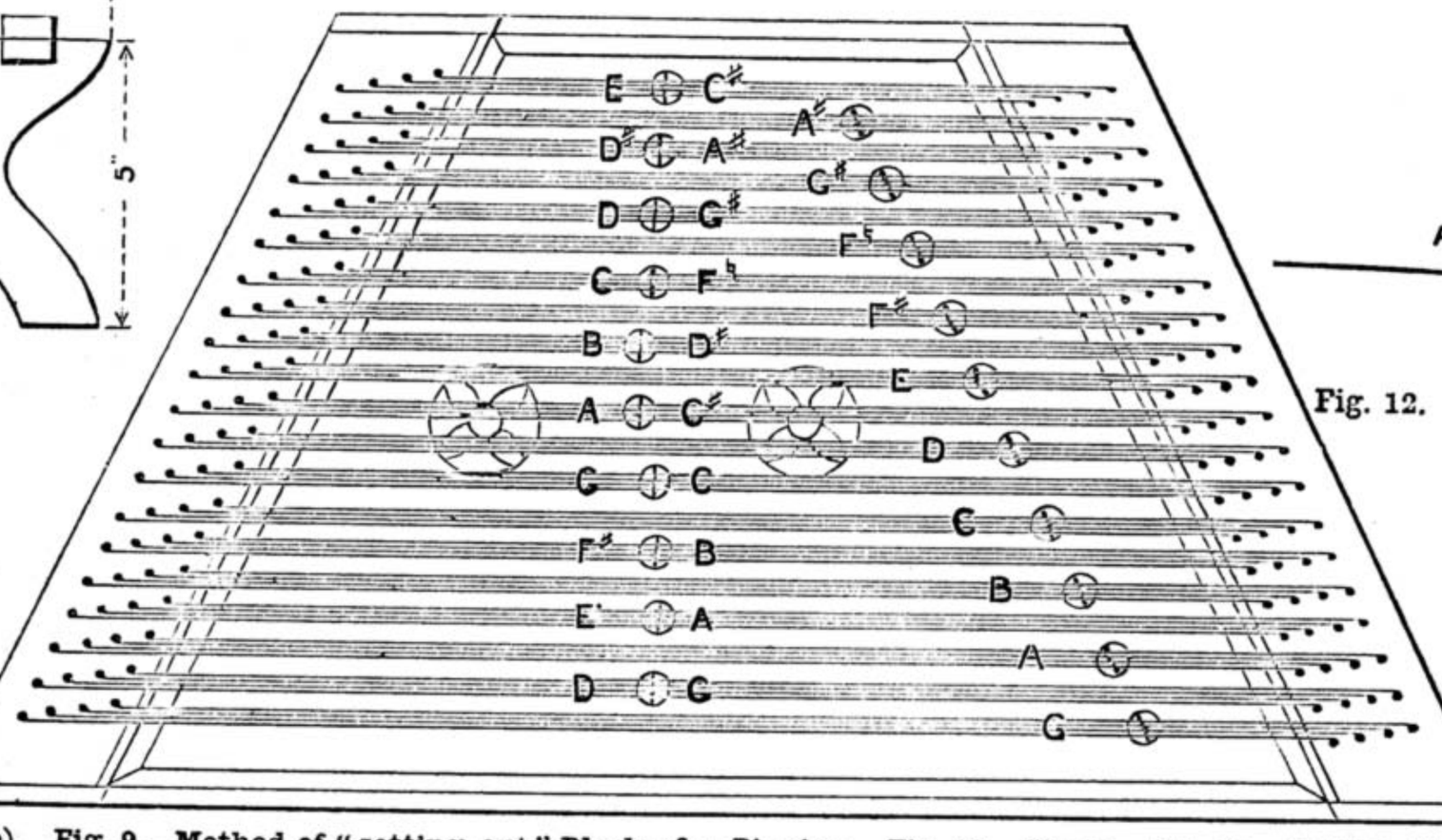


Fig. 12.

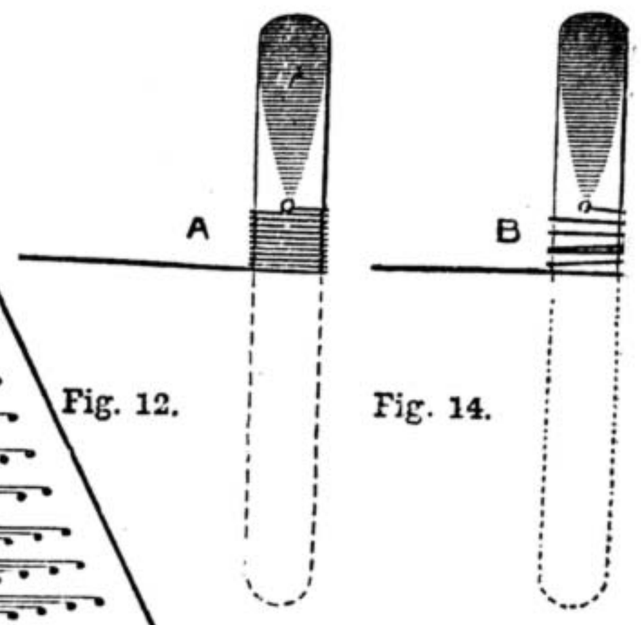


Fig. 14.

Fig. 11.

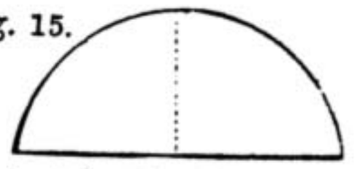


Fig. 15.

Fig. 8.—Wrest-Pin (full size). Fig. 9.—Method of "setting out" Blocks for Pinning. Fig. 10.—Stand. Fig. 11.—Bridge (full size). Fig. 12.—Diagram, showing Scale and Approximate Position of Bridge. Fig. 13.—Eye for String. Fig. 14.—Pin properly wound (A) and badly wound (B). Fig. 15.—Mode of making Moulding round Belly.

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running on too fast—our blocks are not yet pinned. Well, then, just remove those pieces of ribbon again, and commence to bore the wrest-pin block. No. 6 wire measures $\frac{5}{110}$ in. diameter, consequently you must have holes considerably smaller than this for your pegs to work in, or in a very short time, what with the tuning and the pressure caused by the "draught" of the strings, they would soon work loose and the "pitch" run down. Take, therefore, a $\frac{5}{32}$ in. spoon bit, and on it fit a "stop" that leaves exactly 1 in. of the bit for boring. This stop may be made either by boring a hole lengthways through a piece of wood which is allowed to remain on the bit, and which leaves the necessary 1 in. protruding; or by binding three or four turns of copper wire round the bit in the place required. This stop is necessary to regulate the depth of the holes. Start by boring the lowest hole, and be very careful to hold the bit at right angles to the *face* of the block. When the first hole is bored, place in it a piece of wood like a small pencil, about $2\frac{1}{2}$ in. long, which just fits sufficiently tight to be easily shifted. This is to act as a guide for the boring of the succeeding holes, and should be shifted as each is bored, or you will have an irregular arrangement which will not add to the appearance of the instrument. When all are bored out, they must be *slightly* countersunk and the borings carefully removed; they are then ready to receive the pins, which must be *turned* not *hammered* in. This is done with the tuning key.

The hitch-pins are made of brass or iron wire, $\frac{3}{32}$ in. diameter, pointed at one end, and are $\frac{3}{4}$ in. long. A hole is bored with a small bradawl for about $\frac{1}{4}$ in. into the block, and the pin is then driven in till $\frac{1}{4}$ in. is left out. Then go over the tops with a large flat file, so as to get them all quite level, and the instrument is ready for stringing. The blocks may be bored and pinned at any time, but it is better to put it off till after the polishing is done, so as to avoid the possibility of any grease getting into the holes. Get 2 oz. of No. 9 brass wire and 1 oz. No. 8, 2 oz. No. 8 steel and 1 oz. No. 7. This is M.W.G. (music wire gauge). If your wrest-pins are drilled, well and good. If not, make a loop of black thread $1\frac{1}{2}$ in. long, and fasten on each pin at a distance of $\frac{1}{2}$ in. from the top, by passing the loop round the pin and threading the knotted end through it. When the pin is turned to the right this loop will tighten up and gather round. Now that ribbon may go on again, and the pressure bars be laid in their grooves.

Take the No. 9 brass wire, and, holding it in the left hand, unwind sufficient to make one string and twist an eye $\frac{1}{2}$ in. long; finish this eye off by turning the free end of the wire twice round the string, and cut off this free end, leaving $\frac{1}{4}$ in. of "tail" at right angles (Fig. 13). Put this eye on the hitch-pin, and cut off the string 4 in. beyond the corresponding wrest-pin. If the wrest-pin is drilled, insert the end in the hole so that it just peeps through; if not, make a small hook of the end of the wire and insert in the loop. Turn the pin to the right, and see that the string gathers regularly round (Fig. 14). Arrange so that each succeeding string lies on the "tail" of the previous one, and, when the note is complete, place a bridge under it (with one of the pieces of wire previously prepared on top), at a distance of $2\frac{1}{2}$ in. from the right side. Use No. 9 brass wire for the first five notes, and finish the remaining five with No. 8. Get all the brass strings on first, and be careful not to put them on the pegs intended for the steel.

The steel strings are put on in precisely the same manner, and the first bridge is placed *about* 10 in. from the left-hand side. Its *true* position cannot be determined until the instrument is tuned. The row of bridges under the brass strings should stand in a line parallel with the block, but those under the steel strings follow a somewhat erratic course, owing to the intervals into which they divide the strings being unequal. The *scale* is shown at Fig. 12, and also the *approximate* places for the bridges. If when the instrument is raised to pitch the notes given do not exactly correspond with the notes shown in the scale, the bridges must be shifted to right or left till the correct place is found. All that is now required is a pair of sticks or beaters to play the instrument with. Take a piece of stoutish cane, about 15 in. long, and split it into four lengthwise; taper these gradually along their whole length till the thinnest end will easily curl round into an oval; fasten this with strong thread, and round the lower side for about 2 in. bind Berlin wool or yarn till the required degree of softness is obtained. Fasten off with thread, and cut the beater to a length of 11 in. from bow to butt. It is as well to have two pairs, one clothed more lightly than the other, as with these a different quality of tone can be obtained.

One word as to preserving the instrument. It is almost essential that a wood case be made for it, as not only does it keep damp and dust away, but it also makes an excellent resonator to stand the instrument upon when playing; and it is *quite* essential that it be kept as free from dust as possible, and never put it away after using without first wiping the strings with a soft rag to remove any damp that may have got on.

One more—keep it well up to pitch, and don't allow it to get out of tune.

HINTS TO YOUNG JOINERS ON SETTING OUT AND MORTISING.

BY B. A. BAXTER.

THE readers of WORK remember some hints on planing which appeared a short time ago. I should like to explain how the preceding hints may be made useful, and carry forward the instruction given into the region of practical joinery.

We have all read with interest and profit the explanation of plain, tongued, and dowelled joints, and it is unnecessary to repeat instructions given so recently; any of my fellow readers who have not read those articles, are recommended to do so at their earliest convenience.

The beginner, however, ought not to be discouraged if he cannot succeed at first in making a plain joint; when he can do so, he is considerably advanced towards being a practical workman.

The chief difference between preparing stuff for frames, etc., and joining boards, is in the use of the square. It matters nothing if the edges of a joined board were not square when glued together, if only the angle of one is complementary to the other; therefore, in shooting, the same ends of the boards are kept towards the same ends of the bench—the face sides of the boards are in *one* case towards the bench when in the screw, and in the *other* towards the workman.

If upon trial the boards are not in the same plane, the angle must be altered; if the boards appear to stand correctly on trial, care must be taken that the plane is set truly, or by the time the boards are in contact all along (which is of course to be secured) the angle will be incorrect, and the boards when glued will be very much as in Fig. 1.

Now in preparing wood for mortising, we must adopt a plan. First plane one of the largest surfaces truly, mark it, and "shoot" one edge squarely, using the square frequently to test the accuracy of the work. It is of the greatest importance to the beginner to commence rightly.

The reason why he is recommended to carefully surface one of the largest sides of his timber is because he needs to have a data, a starting-point, a standard to which to refer. In all the arts this is the same. The musician must have his standard of pitch and his key-note. The optician must determine on some standard that he may compare various refractive media to each other. The surveyor must have his bench marks, and the artist his horizontal line. The joiner's best plan is to get one surface as accurate as possible, in order that by the aid of squares and gauges he may get the other surfaces true also. Always put a mark on the tried surface.

We will suppose this done, and having set our marking gauges, one to the width and the other to the thickness, and that we have marked with a pencil the already prepared surfaces, mark with gauges and reduce to the stroke, principally or entirely, with jack plane. If there are any mouldings to be "stuck" or grooves to be "ploughed," be careful to select the shot edge and the face side with a view to smooth and satisfactory finish, which will be secured by noticing the direction of the grain; it makes an immense difference to the ease and the appearance of the work of moulding if this is always remembered.

To set out "styles," that is the upright members of a framing, place them *face to face*, the inner edges the same way, which secures the top ends being together; the places for the rails can then be marked on the edges of one pair, or several pairs at once, with a square and pencil or striking-out knife.

The rails do not always so absolutely require being face to face, but it is better to place them so, especially if there are muntings, sash bars, etc., to be inserted. In the case of work with moulded edges, the place for the mortise must be determined by the moulding: the square central portion on the edge of the frame must contain the mortise, unless indeed the whole of the moulding can be cut away where the joints occur. In such a case two parallel mortises can be made, but it is never necessary unless the work is over two inches in thickness.

If there are panels in the framing, then the size of the mortise ought to depend upon the thickness of the panel, or, more correctly, upon the groove into which the panel is inserted. May I repeat in other words? The distance of the first or nearest stroke of the mortise gauge from the face side depends on any moulding that be used; the distance of the second depends upon the size of the chisel used, which should be the same as the width of the plough-groove, if any is present.

In setting out the rails, if any moulding is present, the shoulders wherever the moulding intersects must be as much longer as the moulding reduces the "styles," and the net width of the styles subtracted from the finished width will be the guide to the actual dimensions required. The best plan to set out a framing is to draw on a strip of wood

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a section of the length, and on the reverse side a section of the width to a scale of 12 in. to the foot, being careful to put in all panels, grooves, mouldings, muntings, rebates, etc.: having done this, the dimensions of the shoulders can be seen at once.

Having determined the position and width of the mortise, we will examine the chisel and see if it is in good condition; if not a visit to the grindstone is advisable, for a mortise cannot be made well by a beginner, unless the whole of the conditions are favourable.

The chisel should be ground so that the ground surface is flat or hollow, the edge square and straight, and the angle produced by rubbing on the oilstone not very different from the ground portion.

The angle between the ground portion and the back of the chisel should have no burr or roughness, and the extreme edges may be rubbed enough to remove any roughness that may be left from the grindstone. Our first endeavour to make a mortise can now be made. A mortise is a rectangular chamber excavated in a piece of wood, generally for the insertion of a "tenon"; the chisel usually gives the width of the mortise, and the mortise may be of any length or depth.

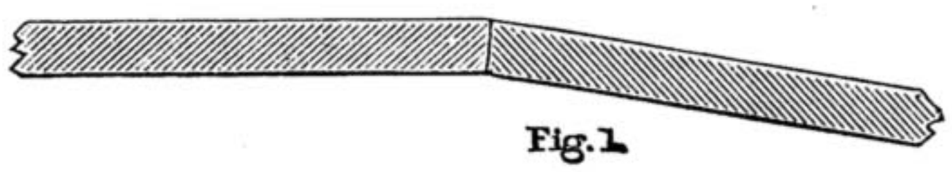

Fig. 1.

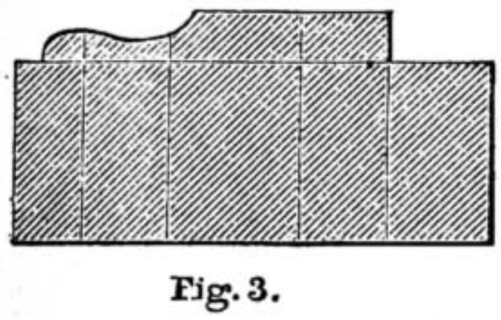

Fig. 3.

CHISEL.

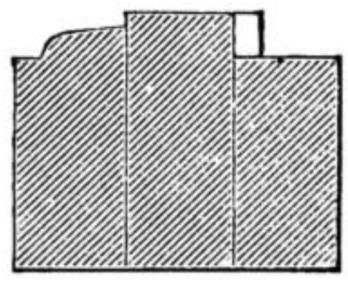

Fig. 2.

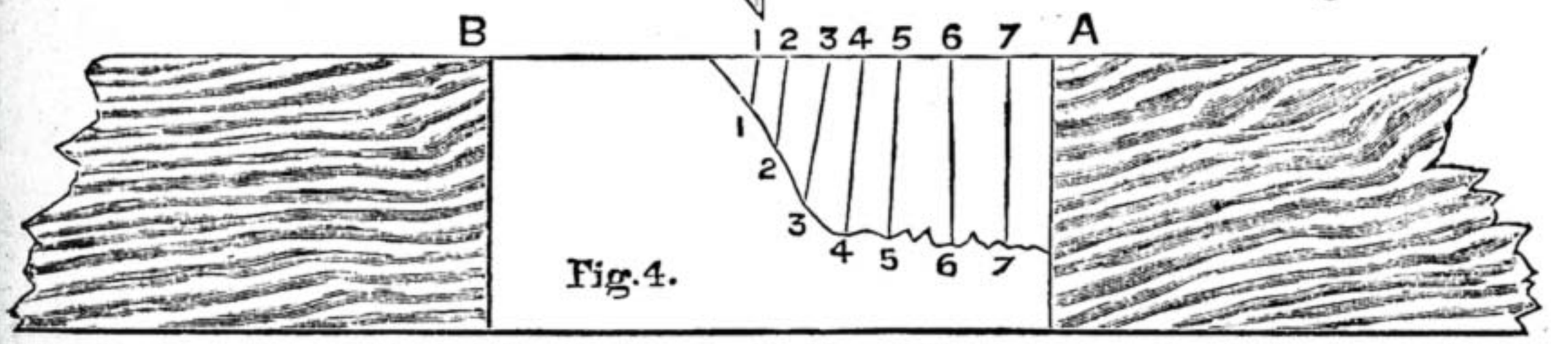

Fig. 4.

Fig. 1.—Section of Boards badly joined. Fig. 2.—Section of Sash Mortise situated between Moulding and Rebate. Fig. 3.—Section of Sash Style having Double Mortise. Fig. 4.—Diagram showing how to begin Mortise in Middle, cutting towards end A: reverse Chisel and cut from Centre to B.

In this, as in every mechanical operation, attitude is of importance. Every one knows that a circular disc does not appear to have a circular boundary unless every portion of the outline is equally drawn from the eye; we all know that a circle drawn on a piece of paper and viewed obliquely gives the appearance of an ellipse. We know too that any three points may be regarded as in one plane, or in other words a plane surface (of suitable dimensions) may be adjusted to touch any three points wherever they may be placed. Now apply these two pieces of knowledge to our humble operation of making a mortise.

Let the centre line of the tool be imagined, and the centre line of the mortise be also either drawn or imagined; these should cross each other at right angles. When the tool is in a correct position to cut, the eye of the workman should be in the same plane as the two imaginary lines we have supposed.

Have I made myself clear in this description? Let me try once more. Stretch a chalk line between two points; at any point on the line stretch another to a point above, or preferably, let a plumb-line cut the horizontal chalk line. You *can* stand so that these two lines range in one line; when it is your habit to do so, you have learnt the true attitude to assume with respect to a mortise.

I fear I have not made this important matter quite clear, but those who already grasp my meaning will, I hope, pardon my effort to make it more simple.

Let us try a simple experiment: Take a piece of wood, draw on it a straight line, on this line stick a straight wire—a mattress needle or a long knitting pin will do; let us now light a lamp or a candle; the needle will cast a shadow which by a little adjustment can be made to lie along the line; the flame of the candle is now in the plane of both the lines; if the learner stick the pin obliquely, he will find it is still possible to make the shadow range, but in that case the light is not *on* or *over* the central line we have supposed, as it ought to be. No beginner can *rely* on making a true mortise unless he can assume this position, in which he can see the direction of his chisel.

There is one other consideration which ought to be mentioned, that is, that if the edges of the wood are not square (and some workmen leave the outer edges to be planed to finished sizes, after the work is glued up), the mortise may be made apparently true, perpendicular to the bench or mortise stool, and yet, because the work is not properly prepared, the mortise is not parallel to the face of the work, as it should be.

Now a few words on the actual work, the manual part I mean. Beginners invariably make their mortises somewhat larger than they intend, because they scatter their energy over the whole mortise, and the core is an embarrassment to them. Let me advise a method. Begin the mortise in the middle, making the two first cuts remove a small piece of the core, then taking cuts towards one end about $\frac{1}{4}$ in. at each cut, and as soon as possible take each cut as deep as necessary; the flat side of the chisel is to be towards the end of the mortise to which you are proceeding. Having arrived at the line, turn the chisel; again begin in the middle, and advance in like manner to the other extremity.

Let the diagram given in Fig. 4 represent a section of the mortise, and the figures the results of each stroke.

I am supposing you can turn the style to finish from the other side. The cut marked 1 may be deepened from time to time; this will remove the core, so that when the mortise is finished, there will not be much left, and what there is will be in the middle, where it is most easily removed. If the mortise is right through, it is better to use a core-driver than to pick out the core with a chisel or other tool, but if it does not go right through, use a sharp chisel somewhat smaller than the mortise chisel.

Mortises that are intended for a tenon that passes through the style usually have the outer portion enlarged for wedging, not of course in width, but in the length; this enlargement for the wedges ought to be a very gentle taper, because taper wedges hold better than abrupt ones. An engineer's key in a cog wheel may serve as an excellent example, or the wedge of a plane is about a correct angle for wedge of tenon; these wedges, when glued and driven, convert the tenon into a dovetail, and also give a little opportunity of adjustment in putting together the work.

It is not always necessary that the tenon should go through; in such cases, care should be taken as to the direction of the mortise; neglect of this would, in case of narrow bars like sash bars, cause them to appear bent; in fact, would bend them.

Although I have said that the size of the mortise depends upon the size of the plough-groove (if present), and the position upon the size of any moulding that may be worked upon the styles, yet the cutting of the mortises is not to be left until these operations are accomplished. The mortises are best cut before either are done, although of course allowances are necessary to be made according to these. If our pupil will draw on the inner edge of styles a section of each rail in its right position, he will not be likely to make any mistake in the planning of his mortises. Every groove, rebate, moulding, etc., should be drawn, and it would be well if a section of styles, muntings, or bars were similarly drawn upon the rails—this would at once give the shoulders, and suggest where either mitring or scribing is necessary.

In all this, I have supposed that the beginner has ordinary woods to deal with, for many woodworkers, as coachbuilders, etc., do not make mortises in this manner. Among these a mortise is formed after marking out by boring away as much as possible of the timber from the centre of the mortise and paring the rest away with sharp chisels. This method is excellent for ash, oak, beech, or other hard woods, saving a large amount of work with the mallet, but a learner must exercise all his care or he will pare away too much in finishing.

About cutting tenons I shall say nothing at present, but our little experiment with the light, line, and needle may again be useful. The shoulders of the tenons in careful work ought to be marked with a knife or chisel, and the tenon saw kept the right side of the line, that is to leave the knife-cut line to form the actual joint, otherwise the saw kerf robs the length of the rail by an amount equal to its thickness.

If any question arises as to insufficient description or unintelligible explanation, it will be welcome, as many of these operations are more easily performed than explained.

In Figs. 2 and 3 are represented, in section, a single and double sash mortise. I have said that the shoulders of tenons should be marked with a knife or chisel. A chisel is, perhaps, the handiest tool by far for this kind of work for the skilled workman, but for amateurs of average capacity, an old dinner or dessert knife that has been broken across the blade, about the middle, leaving a square, or almost square, end to the blade, will be found excellent as a marker.

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THE BROOCH: HOW TO MAKE IT.

BY H. S. GOLDSMITH.

BROOCH TONGUES.

THIS is the first of a series of papers on matters connected with the manufacture of jewellery and goldsmiths' work, and it is devoted to the consideration of the making of brooch tongues.

But before I enter on the subject I have chosen for my initial article, I think it will be desirable to put clearly before my readers the objects and aim that I have in view in writing these papers.

In the first place, the objects are to help the younger members in the knowledge of their trade, and to give them some of the principles on which they should set about their work.

The method will be that of describing the manufacture of every-day articles, beginning with the simplest, and gradually advancing until we get to important pieces of work, such as, for example, bracelets and tiaras in gem work, and caskets, etc. etc., in all gold work.

My aim is to interest and, I hope, to instruct those who wish to improve themselves in the art of manufacturing jewellery and goldsmiths' work of every kind.

If I were to ask ten of my fellow-workmen what was the first article that they tried to make or were taught to make, I feel sure that nine would say in reply: a brooch tongue; and as we must make a beginning somewhere, I thought that would do as well as anything to start with.

Everybody knows what they are, and that they can be bought ready-made for very little money; but the fact of being able to *buy* things used in our trade will not carry much weight with the writer of these papers, for he holds that a workman should thoroughly know how to do things right out, from start to finish; not that we shall always have to do the things treated on, but that the knowledge *how* to do these things is useful knowledge, and, what is more important still, we shall be gaining experience in the materials in which we have to gain our living.

What sort of a living that will be depends on the things we have been taught *and learnt*, on the things we have picked up from fellow-workmen and from books, and the uses to which all these can be put. Therefore you apprentices, for whom these papers are principally written, not only get all the knowledge you can, but try and *think* about your work as well, for it is the lining of your head that will either bring you profit or the reverse—according to the way you have packed it yourself.

First of all, our materials to make the simplest brooch tongue are tubing, or chenier and wire.

The chenier will be made from flat plate of a thickness suitable to the size tube required—it is rarely as thin as size 3, Shakespear Gauge, and may be made size 10, or even size 15 for very large brooches, where a fancy shape such as a barley-corn joint is used.

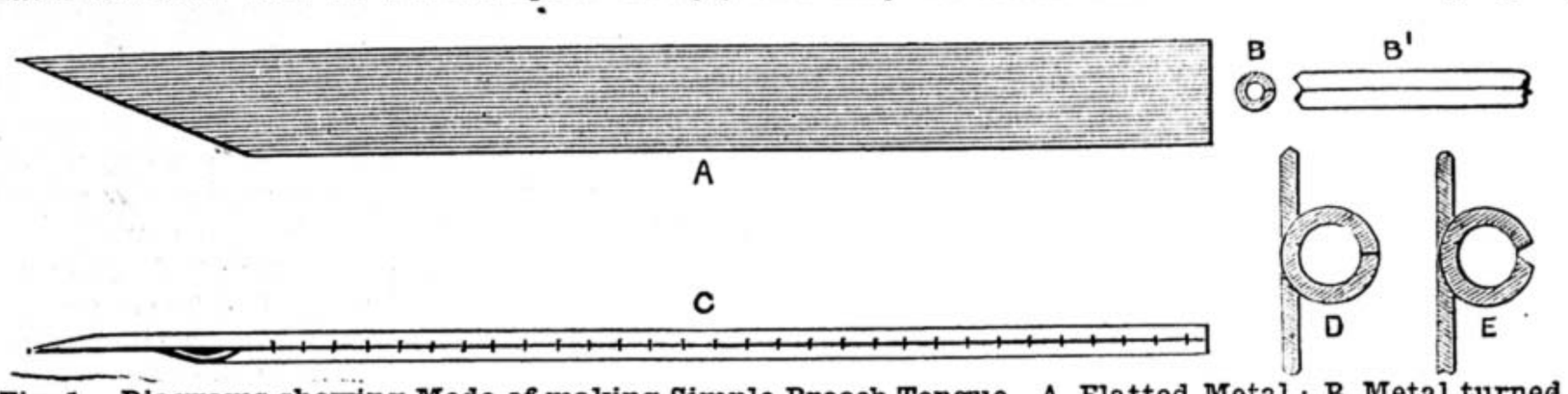

Fig. 1.—Diagrams showing Mode of making Simple Brooch Tongue—A, Flatted Metal; B, Metal turned up, transverse section; B', Ditto, Elevation showing Joint; C, Tongue complete; D, Joint rightly made; E, Joint badly made.

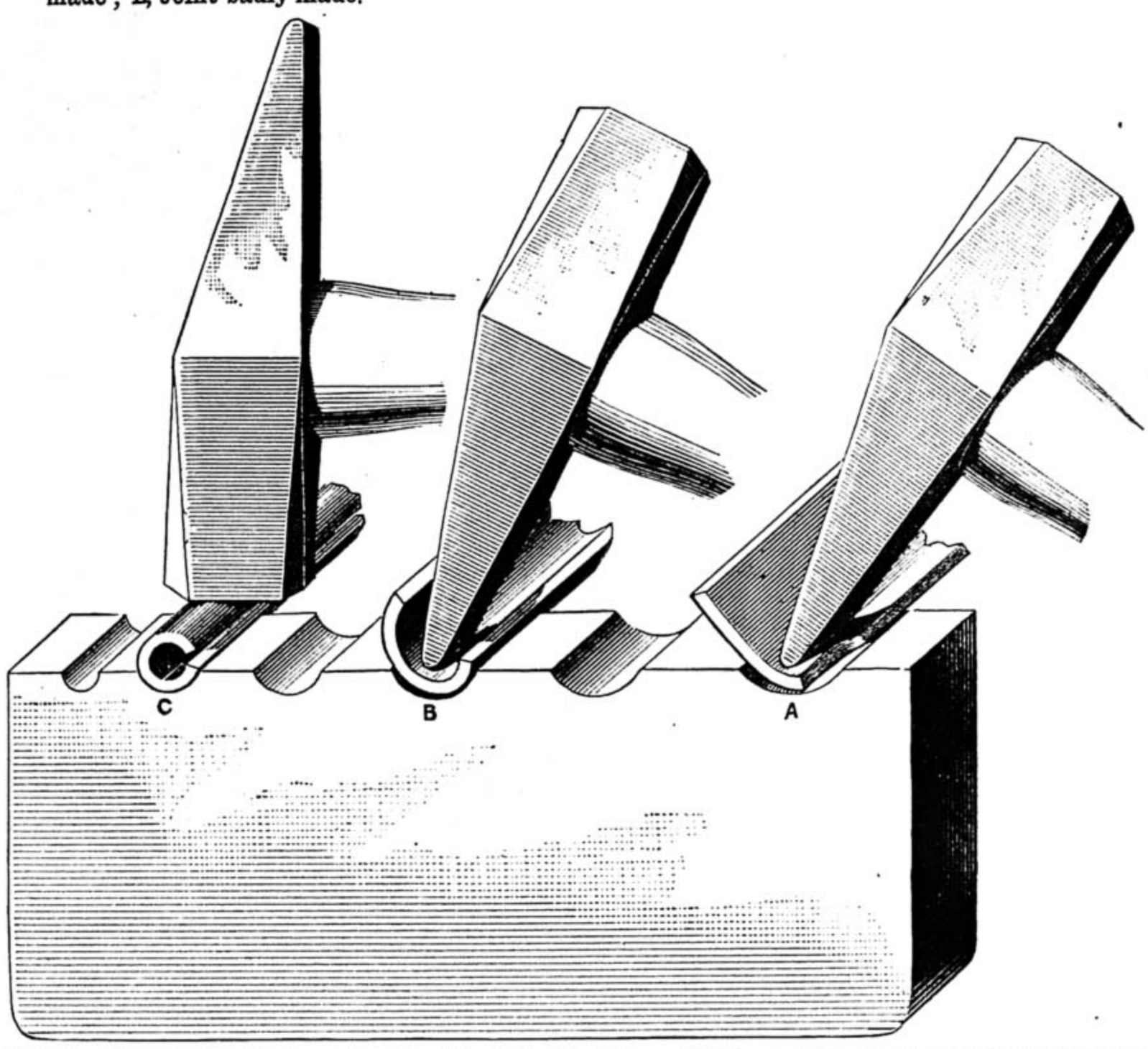

Fig. 2.—Hammering Plate on Bending Block in First Stage (A), Second Stage (B), and Third Stage (C).

Our piece of metal, either gold, silver, German silver, etc., will be first flattened to a suitable thickness. Secondly, cut to length and width required, as in A in Fig. 1. The width of plate is easily calculated by making our plate three times the width the tube is to be, or—to put it in another way—the plate is as wide as three diameters of the chenier. Cut the end off as in A in Fig. 1: make it perfectly flat, and with the borders quite parallel. While filing to regulate the borders, you can at the same time take a little more off the inner edge (Fig. 1, C), so that when the plate is turned up we shall get it to draw quite close, as shown in the same diagram (Fig. 1, D), and not like Fig. 1, E, as it will be sure to come if no provision is made for the different diameters, inside and outside of tube.

This direction is not of much importance in small chenier, but it is very necessary to have that allowance made in large chenier, in order to avoid that sign of bad workmanship. I mean filling up with solder. (I wonder how many of my readers have done that, not thinking it would be noticed by the master—but it was, wasn't it?) Now that our plate is quite flat and true, and with this level properly made, we will proceed to make it into chenier by the aid of a hammer and bending block.

This bending block is usually of hard wood or horn for small work, while for larger and heavier sizes, bronze, brass, or iron is necessary. It is merely grooved out in varying sizes, as Figs. 2 and 3, and is held in the large vice, or else the bottom of a sparrow-hawk block is grooved out and used.

Fig. 2, A, B, and C, gives the position and successive stages of formation; the only remarks I have to make in addition are first, that the metal should have been annealed; second, that the edges are got up before the centre; third, that the pane of the hammer is of a nice rounding form, and not sharp at the ends, where it might cause some nasty dents.

Fig. 3, A and B, is the wrong way of making this chenier. It is easy to see that the outside edges will get reduced considerably before the draw-plate is able to get our tube round on the outside, and even then the hole, instead of being round, will retain some of the pear shape it originally had. No amount of clearing the hole out with a joint-brooch will correct it, and altogether we shall not be able to get a smooth working joint, as we should do, and such as we do get, when the tubing is properly made. Chenier drawn over a mandrel will be dealt with later on, when we come to consider joints of boxes, lockets, etc.

In order to finish our chenier ready for soldering on, it should now only require to be drawn through a few holes in a draw-plate to get it to our size.

Perhaps even during this process we may find that the point is too weak to stand the strain of drawing down. If that is the case, we shall have to strengthen it by soldering it up, or else by introducing a piece of wire,

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and soldering that as well. You must use your own judgment whether the latter method is necessary; generally, neither is required for the common run of brooch joint.

It is then annealed in order to clean it from any grease it may have picked up in its passage through the draw-plate, and put in the pickle (vitriol, 1 part; water, about 30 parts). Warm is best, but cold will do if you are not waiting for your work. Take it out of "pickle" when clean, rinse it well in clean water, and dry it. If the metal we are working is rather hard, it would be as well to tie several pieces of iron binding-wire round it in order to keep the seam closed up; or else, as we shall do later on, to wind iron binding-wire all round from one end to the other.

After drying it, score it across the join or soldering seam with a saw or three-square file, like Fig. 1, C, when it will be ready for use.

The wire out of which we are to fashion the tongue should be drawn down to the proper size, and should not have been annealed for the last six to twelve holes, so as to have it rather hard.

Now to make the tongue, which, after all, consists merely of soldering a piece of wire on a piece of tube. Cut a piece off the chenier and place it on a piece of flat charcoal or pumice-stone, in which a notch has been cut or filed to keep it from running away; and see that the seam is just where the wire will cross it (Fig 4, B), and that this part is scraped clean, else the solder will not hold.

The part of the wire that crosses the chenier should be hammered just a little, so as to get a slight flat surface to rest on the chenier. Scrape the part that comes in contact perfectly clean, and then proceed to solder it, only don't make it red hot all along. Remember that we have drawn it down hard, for a reason that will appear presently.

Having soldered it, I hope you have done this without filling up the hole with solder. You can always prevent this by placing a single horse hair through the hole. It will not be necessary after a time, but new hands do the very things you do not want them to do whenever you give them the slightest opportunity to go wrong.

Is it necessary to tell you that if your piece of joint is long, you must take care to solder the seam right to the ends; or should I leave such common-sense matters to you? I now and then see this left undone, therefore I here speak of it; but when I do meet with this, I can tell you I don't think much of the fellow that does it—or, rather, that does not do it—he is almost past praying for.

Now to finish the tongue. First it has to be boiled out, or "pickled," to remove the charred borax, etc. Then it has to be hardened, and, thirdly, fitted to the joint, filed up, and given the proper shape ready for the polisher.

The second stage only concerns us now. We have had to pickle the chenier, so you know what that means. And please remember, now and henceforth, that work from the boiling-out pan or pickle pan must always be rinsed in the clean water pan that should stand beside it under the soldering jets; or, if they are fixed to the board, then on the pickle shelf. A good deal of bother would be saved if this were always done.

If the tongue we are making be a 9-carat gold one, merely hammering it round and round on the flat iron, small anvil, sparrow-hawk, or beck iron, or whatever you use in your shop, will be sufficient; but if we are dealing with German silver or gold of a better quality, then it should be twisted (Fig 4, A) as well before we hammer it, else we shall find it is not hard enough. You see in Fig 4 that it is being twisted *only* near where it has been soldered; the other part that is held in the vice was drawn down hard purposely, as you will remember, in order to save trouble in doing work twice over.

The fitting into the joint is so simple that it wants no description; but it will need care and skill, too, to get it to fit well.

Now, as to filing up, it should be given a good shape in section; generally, it is either round or oval, although occasionally I have met with them triangular or bayonet shape.

The points should be filed the shape of Fig. 5, A, B, C, D, E, F, G; not the shape of Fig. 5, H, I, J.

I don't think any words are needed to point out the weakness of Fig. 5, H and I, or the clumsiness and ugliness of J. Just let me whisper that the end should be filed to a *point*, and not left partly done, as you do sometimes.

In reference to the shape or curve (if any) that a tongue should take, the illustrations are surely sufficient, particularly if you remember the work it has to do is like that of a bayonet or sword, not like a corkscrew.

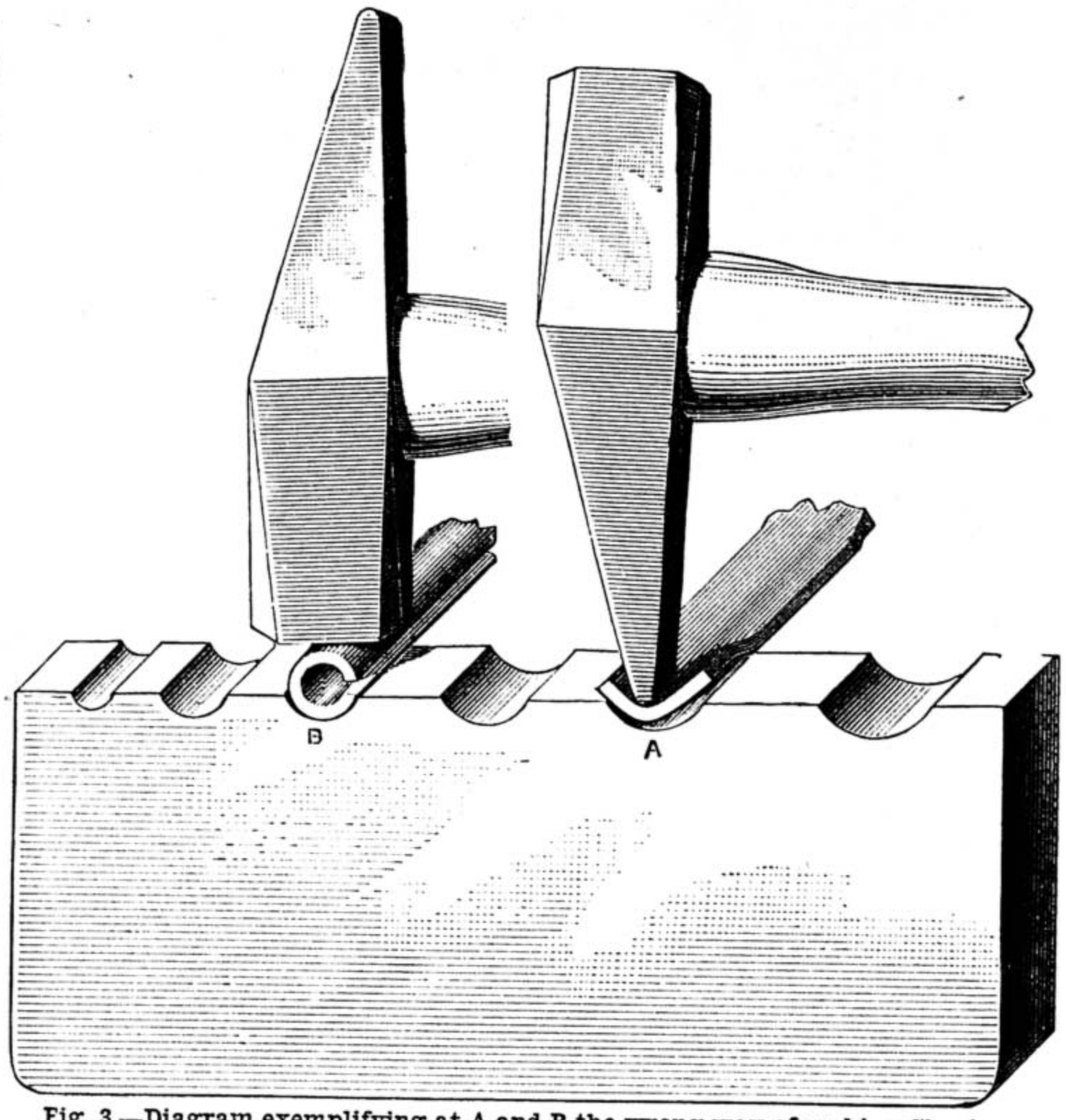

Fig. 3.—Diagram exemplifying at A and B the wrong way of making Chenier.

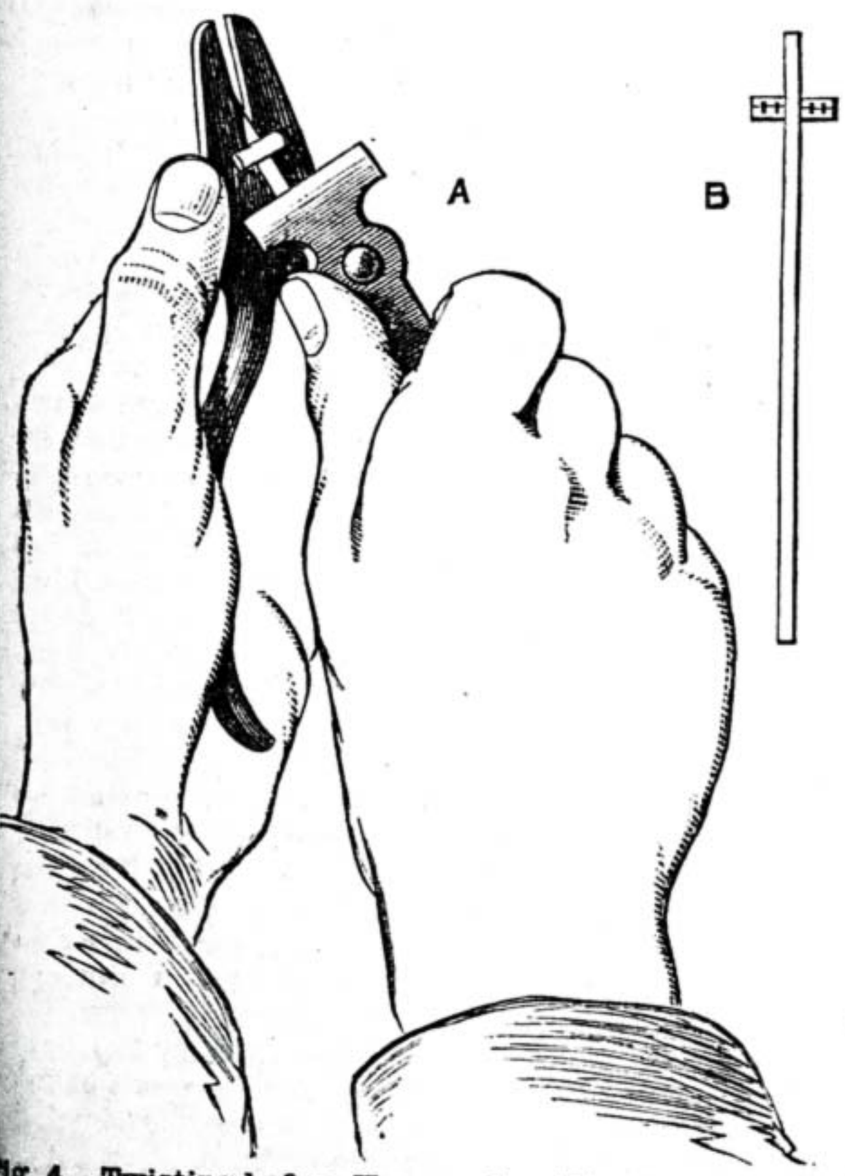

Fig. 4.—Twisting before Hammering (A); Metal before Twisting with Top attached (B).

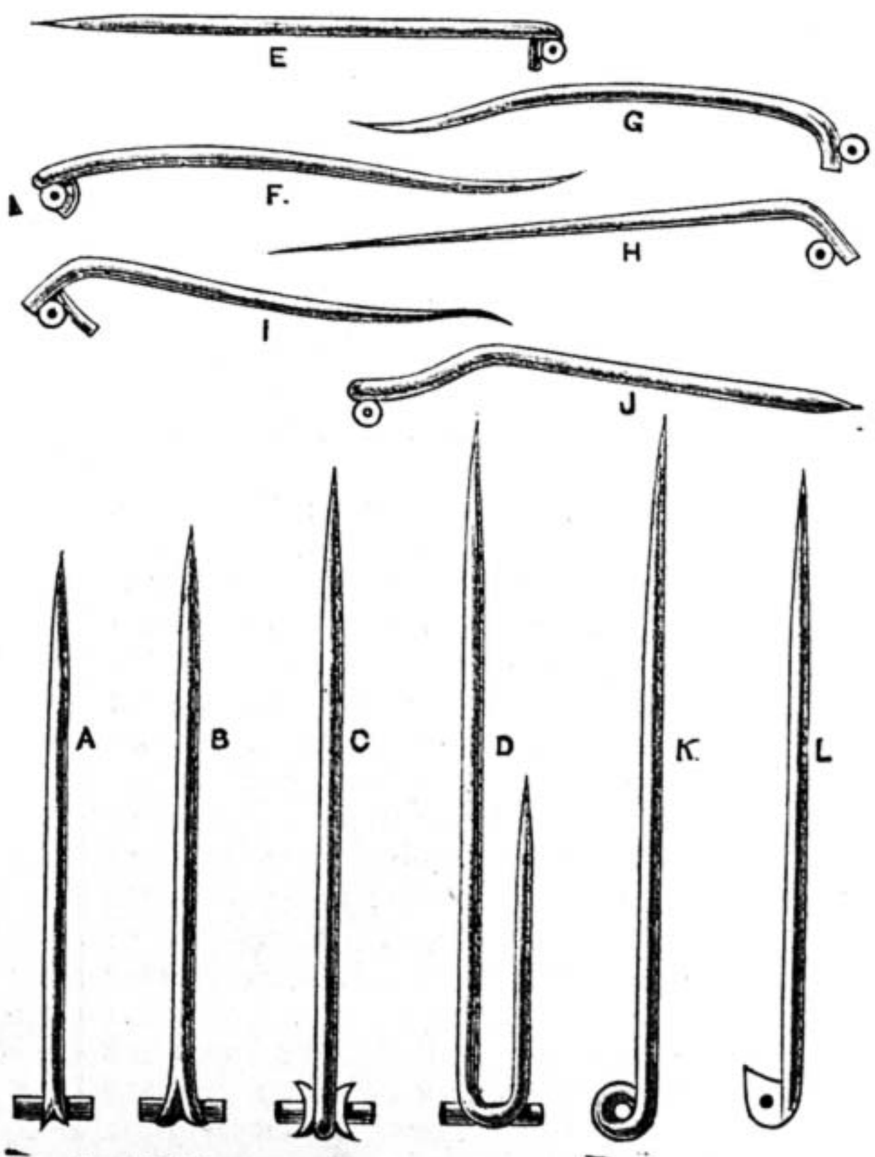

Fig. 5.—Right way of filing Point, A, B, C, D, E, F, G; wrong way of ditto, H, J, K; Wire turned round and soldered, K, L.

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It has to pierce, not to wriggle, through cloth or other dress material.

The different ways there shown are all matters of every-day occurrence and explain themselves, with perhaps the exception of the double one shown in Fig. 5, D, which is intended to prevent a top-heavy brooch from tilting forward.

At K, L, in Fig. 5, two brooch pins are shown which are made differently from any of the others spoken of. K is simply the wire turned round and soldered, and this is used with a joint to be shown in the next paper. The illustration to be then given is one form of so-called Etruscan joint.

The pin at L is made with a flat plate, which is afterwards drilled and filed into shape. This also will be further noticed in the paper on joints.

Hardening the tongue should have much more attention given to it than it generally gets; for on the power of the tongue to act as a spring always pressing against the top of the catch the safety of the brooch depends to a very great extent. Perhaps if notice is here taken of this matter it may help us to get these tongues made properly. Surely they are simple enough to do, yet I find many workmen will file up and finish a tongue in great style as far as appearance goes, but the lady, on placing her brooch in her dress for the first time, finds the tongue bend just as though it were made of lead or copper. Such men cannot but know the proper way to make them, but they are not conscientious, and I am afraid set a very bad example to the juniors. Shall I be saying too much if I say that those who skulk their work in these small matters are a disgrace to their trade?

The very men who leave undone the part of the work on which safety so often depends, and which would not take them another five minutes to do, are those that growl and think themselves hardly done by when the foreman recommends the retention of a more conscientious, and may be younger, man in their stead, if it is necessary to choose—as it sometimes is. The one may have less experience, and may not have such an all-round knowledge of work, yet he will improve; while my daily experience as foreman teaches me that a tendency to skulk or shirk once shown will increase until it is almost impossible to suggest that they be given another trial, after they have once been "sacked." It causes trouble to everybody, and I much fear sends them down a few steps lower, and mostly, if my observation is not entirely in error, through their own fault.

On the other hand, I have the pleasure of knowing many members of metal-working or engineering professions whom it has been a real pleasure to work with in their classes for teaching technical matters: they take such an interest in their work. Has the lack of technical education in matters connected with this trade anything to do with the scarcity of really first-class workmen, and the miserable way many of them turn out work just a little different from the usual run? I believe it has, and if the ruling body of the Goldsmiths' Company will only consider the possibility of forming such classes, I feel sure that many who are willing to learn will avail themselves of them; and as for the others who do not want to learn—well, they can go about their own pleasures. All I dare hope for is that opportunities may be given to those wishing to advance themselves, as is done in nearly all other trades except this one. To any one who really takes an interest in his business, the gift of a large sum of money a few months ago for technical classes, which *do not include* ours, by the Goldsmiths' Company causes a great feeling of injustice; and this thought will arise: Are those in authority there in any way connected with the trade? It surely is open to great doubt when they help members of other trades to rise, and by their lack of interest in their own trade they deprive its members of gaining knowledge, which they admit is right in other cases, but not in ours. Surely the trade of goldsmith and jeweller is an artistic and scientific profession, and should be encouraged more than by the few prizes given by the Society of Arts, and others, which are for the highest class of work, and for which there is no opportunity of preparing oneself.

It is the improvement in general work and a knowledge of the principles on which it should be done that is wanted most at the present time, and I regret very much that more powerful pens than mine have not taken the matter up long before this.

Enough of that for the present, but I hope I may be allowed the privilege of writing a few words on other matters to which, I think, attention should be called.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

113.—DALE'S NEW CHIMNEY TOP "EJECTOR."

At this season of the year the wintry winds, blowing in fitful gusts from every quarter, too frequently remind us that we have not yet arrived at anything like perfection in the methods at our command for warming our rooms and getting rid of the smoke that escapes upward from our fuel by reason of imperfect combustion. A composition has been produced with which we are to doctor our coals and render them smokeless at the cost of 1s. 3d. per ton—a most excellent thing in its way, if the results to be obtained from its use are in accordance with the promises made by its proprietors. I have not yet had an opportunity of testing this new substance, but it is my intention to do so, and tell my readers my experience of it, with as little delay as possible. Meanwhile, however, let us consider Dale's New Chimney Top "Ejector," a variety of "tall-boy" which, from its construction, seems likely to facilitate the escape of smoke into the open air without being driven back again by a downward draught to the place whence it has come, to make its way into the room itself, to soil with unburnt carbon and nauseate with its objectionable odour. The external appearance of the "Ejector" is shown in Fig. 1, and a sectional view in Fig. 2. From these its construction and action may be easily understood. The invention, as applied to chimneys or as a ventilator, has for its object improvements in its make for maintaining in either a continuous upward current of air, thereby preventing the down blow by the sudden or accidental cessation or reversal of such current of air. The chimney top itself is made in two parts—namely, the lower or central pipe, A, which is surrounded by an outer or external case, B, sustained by four triangular supports, C, which act as guides or channels to assist the upward current of air between A and B. It will be noticed that the lower end of the upper part, B, is so constructed as to form a cone-shaped projection, and round the central part of the lower portion, A, a piece of zinc is soldered on so as to form another conical projection, the counterpart of the projection above, and placed in a reversed position. The supports, C, are attached to the cones, D, D, and form the connections between the upper and lower portions of the chimney top. Thus between each pair of adjacent supports is a space to admit the ingress of air from whatever quarter the wind may happen to blow. The smoke ascending from below enters the lower portion, A, and makes its way into the upper part, B, in the direction shown by the central arrow, and having attained this point it is driven onwards, upwards and outwards, by the current of air which enters the spaces between the triangular supports, C, and proceeds upwards between the lower and upper parts of the chimney top, as shown by the arrows on each side. Thus the return of smoke down the chimney is prevented, for any downward action of the wind, or down draught, is prevented by the up-rush through the spaces between the supports shown at C, C. Of course, it is not possible to speak with absolute certainty of the performance of any contrivance of this kind without trial, but as far as theory goes it seems all right enough, and sufficiently good to warrant its trial by any one who is unfortunate enough to have a smoky chimney, which has been pronounced incurable. The Chimney Top "Ejector" is the invention of and is made and supplied by Mr. Walter Dale, 22, Malvern Road, Kilburn, London, N.W. It should be said that it can be made to fit any existing chimney pot, or with a square base, as shown in Fig. 1, for building in with brickwork—14 in. by 9 in.—in zinc, or galvanised iron, as the purchaser may prefer.

If any reader has tried the chimney top here described I shall be glad to hear the result of his experience, and to learn if its performance is equal in every respect to its promise.

THE EDITOR.

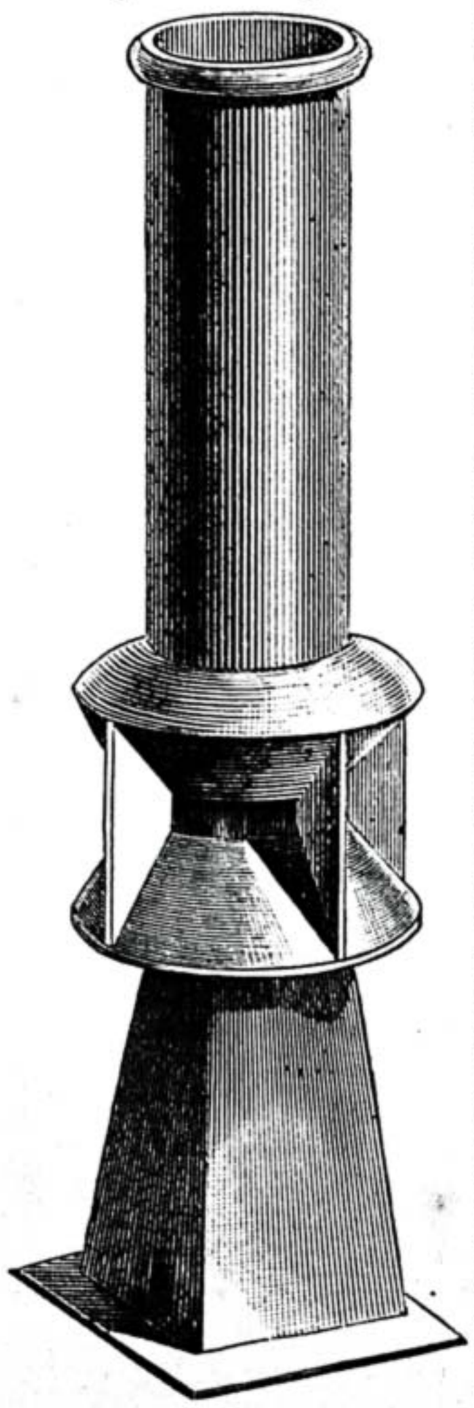

Fig. 1.—Dale's New Chimney Top "Ejector": external view.

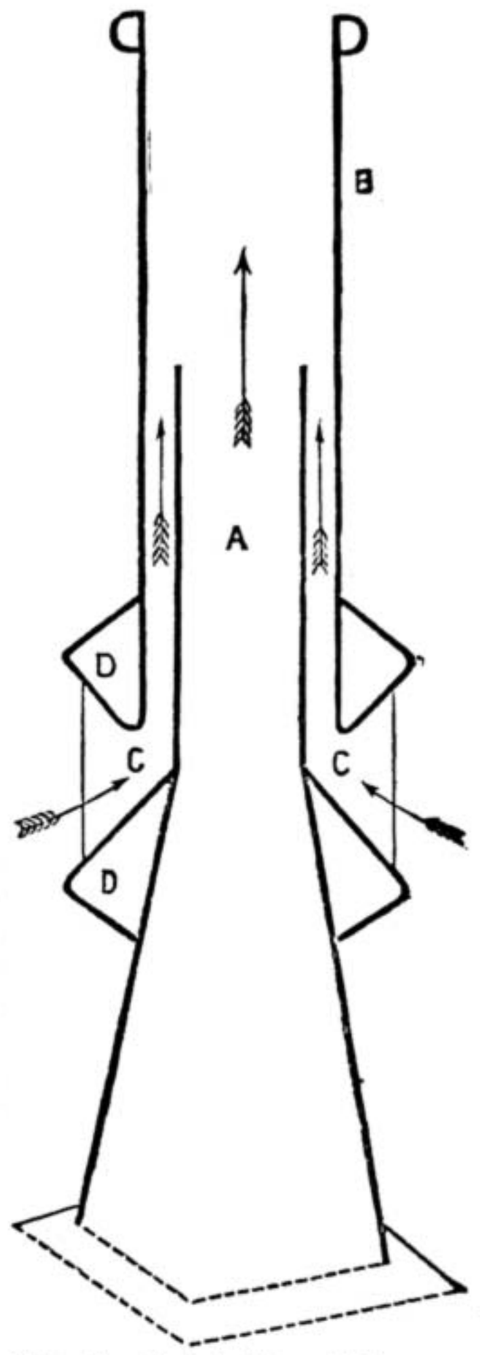

Fig. 2.—Dale's New Chimney Top "Ejector": section.

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SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Bookbinding and Book Boxes.—R. W. S. (*Leeds*) writes:—"I hope you will soon be able to give us the articles on bookbinding, promised so long ago as May (in No. 7). The year is drawing to a close, and I daresay many of your readers, like myself, would like to bind their loose pamphlets and parts, etc.—the accumulations of the year—and place them upon their bookshelves. I have already tried my hands upon making book boxes, for keeping small papers, catalogues, etc., in a handy way for easy reference, and find them most useful. A friend procured me a number of cast-off cloth backs, removed from the books by the binder for enclosing them in more expensive bindings. These, with cardboard sides covered and lined with marbled and glazed papers, quite ornament the shelves, and cannot be detected from the genuine books. A loose index placed in the bookcase gets over the difficulty of the lettering not indicating the right contents. If you think that a description of how the boxes were made would interest the readers, I would be willing to forward an illustrated paper on the subject. I trust, when we do get the article on bookbinding, that we shall have the cheaper forms of bindings treated of at length, as I daresay the majority of amateurs would hardly care to tackle the expensive leather covers."—[The bookbinding papers will be given at the earliest possible date. Meanwhile cannot R. W. S. gather any useful hints from the articles "Binding Made Easy," in Nos. 6 and 9 of Work? I should be glad to see the paper to which you refer, if you will send it me on approval.—Ed.]

Printers' Rollers.—J. O. W. (*Bridgwater*) writes:—"I see a correspondent in No. 34 (see page 541) gives instructions for making printers' rollers, but he is certainly wrong. '1 lb. of glue to a gallon of treacle' would make a mess, but not a roller. Take 1 lb. of good glue, crack it up, soak in water a couple of hours, then put it on the fire to melt on the same principle as a carpenter's glue pot—vessel in a vessel. When melted, add 2 lb. of treacle, stirring it occasionally and letting it simmer together until well incorporated—about a couple of hours—when it will be ready (after scum is taken off) to pour into warm, oiled mould. Don't stir for a quarter of an hour or so before pouring, or you will get air-holes in roller. Let it stand till thoroughly cold (next day is best), when you may pull out. An amateur with a little ingenuity may easily make a small mould from tin, or a tin canister may be utilised. The quantities given are what I have used in practice, but rollers may be made harder or softer by adding more glue or treacle as the case may be. Printers' rollers are now extensively made from a different composition made of glycerine and gums, which composition may be bought ready for casting of any of the printers' brokers at from 1s. to 1s. 6d. per lb."

Working Drawing of Tramcar.—W. M. C. (*Glasgow*) writes:—"Would F. C. (*Leytonstone*) oblige me with tracing of above with measurements? I will gladly pay for it. Also drawing with measurements of the common cab."

Lacquer for Iron and Steel, etc.—A. J. L. (*London, N.W.*) writes:—"What Steel (see page 526) requires is, I think, either the 'Karnwood steel enamel,' or Koch & Co.'s 'varnish for metal and wood.' These are both of them blue and used cold. I cannot give the preparations, as I believe them to be secret."

A Simple Incubator.—W. H. J. (*Belper*) writes: "In No. 35, page 557, W. L. (*Kingsland*) writes how to make a simple incubator. Will W. L. please say, through 'Shop,' what size lamp is wanted, and what heat the sand should be kept? I hope to hear from W. L. soon."

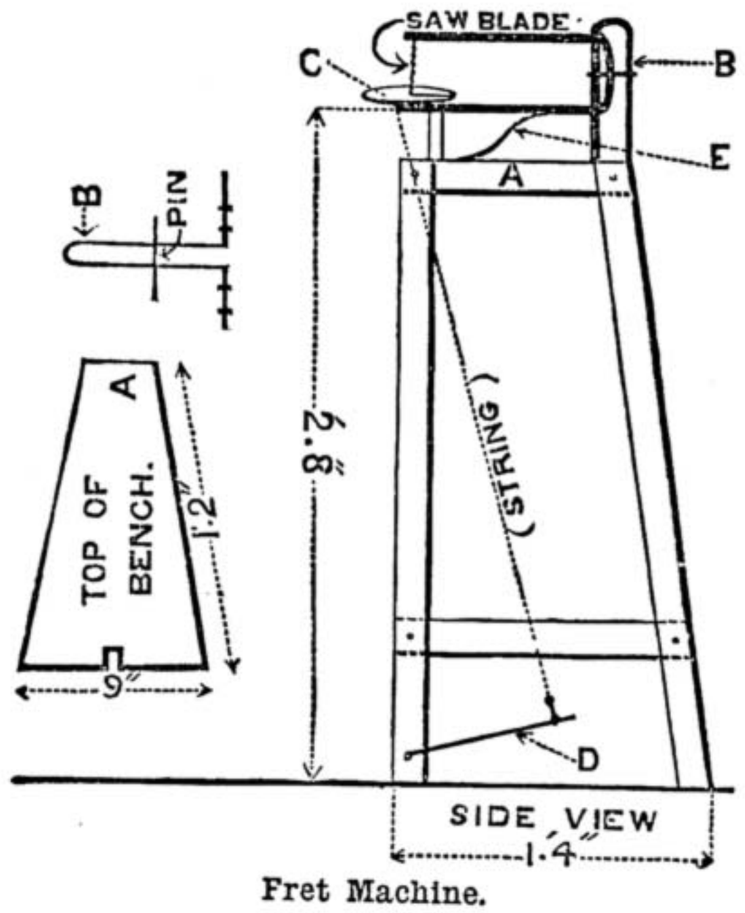
Wheeling.—G. W. (*Bournemouth*) writes:—"The mild effusion of Wheelwright's Clerk (see page 587) was partly caused by punctuation, or want of it. My meaning was for amateurs liking to try wheeling, to take the Editor's tip to Trench (page 237)—prepared wood, etc. It may be new to some (the fact, I admit, is not so old as the pit frame) that the major part of stamped forgings used in the trade comes from France. The average wheelers' trips to Glasgow, etc., are, or have been, on shanks' pony (see U. K. S. reports)."

Useful Scroll Saw.—Verdant writes:—"If Artist in Wood (see page 476) would kindly give a few more details concerning the above, I should feel greatly obliged. For instance, die of fly wheel, length of slide rods, how attached to saw? how is the saw strained or tightened? and how is the saw frame made?"

Small Foot-Power Bellows.—Medicus (*Hampstead*) writes:—"As many amateur mechanics like myself often have occasion to do some soldering or brazing, it would be a great assistance to us if you would give us a paper with sketches showing us how to make a small foot-power bellows with continuous blast to be used with the gas blowpipe. I have the latter, but I daresay a good many of your readers would be glad to know how to make this for themselves, if you would describe it in addition to the bellows."

Polishing Wheels—Tube Saws.—A Regular Subscriber (*Liverpool*) writes:—"I would like to ask Opifex through you which of the receipts for polishing wheels, given in No. 24 Work, page 371, he considers best suited for putting a fine edge on wood-turning tools. I would also like to ask S. M. (*Skelwith Bridge*) if he thinks the tube saws mentioned in his letter in 'Shop,' Work No. 27, page 428, would be suitable for cutting oak across the grain, say up to 2½ in. diameter, in a 4-in. foot lathe."

Easily-Made Fret Machine.—A. J. P. (*London, S.W.*) writes:—"I send you sketch of one which I think much more simple than the one in No. 21, page 332. I made it myself; it is my own idea; I have had it in use for about four years, and



Fret Machine.

find it works well, and is very easily made. It consists of a small bench made of any pieces of wood of a suitable strength, and an ordinary hand frame of either 12 in., 15 in., or 18 in. from saw to back. First make a bench as shown at A, with three legs, a piece of hoop iron or wood, B, or small table, C, for working on treadle, D, and small steel spring, E. The cost of the whole is about 3s. If you do not quite understand the sketch I will send you a small model in cardboard."

Combined Bench and Tool Chest.—Tyro (*Hull*) writes:—"I notice in No. 33, page 524, of Work, a drawing of and instructions for making a Combined Bench and Tool Chest, by Mancuniam. I think it an excellent testimonial to the value of Work, as an assistant to the efforts of the amateur mechanic, that Mancuniam, from being—as he owns he was—only a tyro previous to the advent of Work, should, in the time that it has been before the public (33 weeks), be able by its aid to make such a useful article as the one he describes. Being somewhat of a 'wood-spoiler' myself, and having only a limited space in which to exercise my talent (?) in that line, and to stow away the tools I possess, I at once, on seeing Mancuniam's article, became fired with the ambition to construct such a one for myself. I should, therefore, esteem it a great favour if Mancuniam would, through your columns, state the quantity of wood required, and the probable cost, as hitherto my experience in wood-buying has been very limited."

Tool Wanted.—B. A. B. (*Hampstead*) writes in reply to Gauge Point (*Paris*) (see page 446):—"Two accurate 2-ft. rules will quickly and correctly measure any opening less than 4 ft. For wider ones Gauge Point might get one 3 ft. as well, or a pair of 5-ft. rods as used by surveyors. These will measure correctly and easily any dimensions between 5 ft. and 10 ft. I see nothing makeshift about it, and believe that if it were needed or if it were possible some simpler plan would soon be introduced. I do not see that any improved tool is called for. As to bevel for stair rail joints again, how can any tool be invented to fulfil conditions so varied, and which it is impossible to indicate beforehand! Gauge Point appears to want a universal template cheap and handy. A good plan to adopt for a square across hand rail if straight is a very thin steel straight edge made of clock spring steel. This, which must be wide to be correct, is very useful for squaring any rail that is straight and not tapering. As to a bench grip for veneer or a door, Gauge Point ought to consult the advertisement columns, looking for 'instantaneous grip vice.' There is now no difficulty about it. The only thing is to keep the thing in order when bought. Ordinary care will do this."

An Easily-Made Fret Machine.—H. S. R. (*Highbury*) writes:—"I notice in Work (see page 525) a reply to my inquiry of how the fret machine is to be worked, and must thank W. R. S. for his courteous reply, and shall be very pleased if you would give me his address so that I might be enabled to accept his invitation and see the machine at work. Since my letter to your most valuable paper, I have seen very many inquiries about this same machine, so that this shows that I was not the only one who could not see how it was to be worked. I am afraid I wrote a little prematurely about this machine, as I think I can see now what W. R. S. means, although there are a few little details for explanation which can only be explained by my seeing it at work. I should not have taken the trouble to write about this machine, only that I take a great interest in the paper and everything that is in it, and wait for its appearance with the same interest as I should the weekly part of a novel, as I consider it a most interesting and valuable paper, from which I have got many suggestions which have been of use to me. I might say that I have no intention of correcting the machine (could I do so), as I have little doubt that, from what W. R. S. says, it is perfectly feasible."

About Scrapers.—Scraper (*Cottingham*) writes:—"I have taken your paper from its commencement, and have gathered some very valuable information from it, which I should have taken an earlier opportunity to acknowledge, but I have seen so many letters of congratulation (and discontent) that I thought you would be tired of it. The article I more particularly wish to mention appeared in No. 24 of Work, entitled 'A Few Words about Scrapers,' by a Cabinet Maker. I had heard of this tool some time ago, and not knowing exactly what sort of thing it was, inquired at my tool shop, and bought one, but to my annoyance, when I tried to use it, I could make nothing of it. I scraped till the perspiration rolled off me, but not the slightest impression could I make, and at last threw it aside in disgust. I did not pay much attention to the article on scrapers when it appeared, as I think I had scarcely got over my previous annoyance; but having this week a little job on hand requiring a nice surface I thought of the article, and leaving my work, looked out the paper and read it carefully. I thought what a flat I must have been, for I knew that chisels and other cutting tools were not usually sold in working order, and I might have known that scrapers were the same, but I didn't. However, I went to work again, followed the instructions to the best of my ability, and to my great delight dressed up the wood to my entire satisfaction, and at once determined to write the first opportunity and thank the writer for his useful hints."

Index.—A. X. E. (*Nottingham*) writes:—"I think the suggestion of Barehead (see page 415) a very good one, although perhaps it might not be convenient on the first page, as he suggests. It might find a convenient corner somewhere, perhaps in place of the fly sheet I sometimes find snugly folded in my weekly copy."

Men Worth Knowing.—A. X. E. (*Nottingham*) writes:—"I can fully bear out Help Each Other's remarks on page 316, No 20, about Mr. Pool's tool warehouse being a good and cheap one. I have traded there several years, in fact, ever since he started in business on his own account. I was in his shop only last Saturday, and seeing a copy of Work on his counter, I remarked that I had seen his name mentioned in it, and he replied, 'Ah, you see what it is to have a good reputation!' And, being myself a native of Spalding, I can also bear him out in what he says about Mr. Massey. Perhaps cheap labour has something to do with cheap production there."

Plane Iron Bevel—An Amateur's Dodge.—R. H. (*Newcastle-on-Tyne*) writes:—"Finding a great difficulty in getting a straight, smooth, and even bevel on my plane iron, I found the following give a capital cutting edge, which worked very smoothly:—Take the iron out and unscrew the plate, set it ¾ to 1 in. from edge, and pass the whole through the sole of plane as far as it will go, depending on size of mouth. The iron will now project about ¼ in. Take sharpening stone in hand, and resting one end on back of plane work it over the projecting iron. The angle formed gives the cutting edge. I noticed some little time ago in Work instructions, etc., to sharpen a plane. It struck me at the time that perhaps my dodge would prove of service to many amateurs who have found a difficulty as I have in getting a straight and even bevel on the plane iron, so here it is."

Etching Mordant.—W. J. P. (*Tunbridge Wells*) writes:—"Having noticed the reply to Cupid (see page 541), wherein the informant says he never heard of such a compound as an etching mordant, I beg to offer the following information. The mordants used in etching vary much both in strength and materials. I have never used but one mordant, and that consists of about half nitrous acid and half water. This is rather a rapid bath, and I should say the biting in would be accomplished in about half an hour in all. The nitrous acid should be purchased in a stoppered bottle, and should be of a yellowish colour. I shall be pleased to furnish your correspondent with a further list of baths if required, and any other information in my power on the subject."

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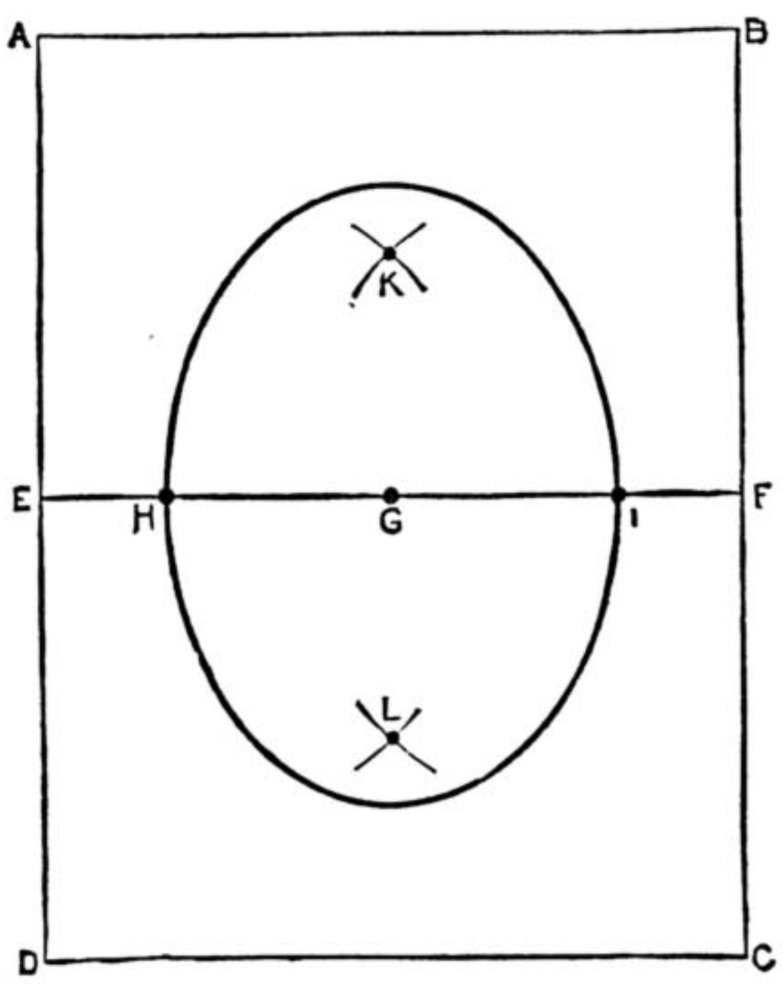
II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Artificial Wood (Willesden Paper, etc.).—G. P. (*Openshaw*).—I imagine what you have in your mind is the welded Willesden paper, the manufacture of which depends on the following considerations:—It has long been known that a solution of cuprammonium hydroxide has the power of dissolving (or apparently dissolving) cellulose. I say apparently dissolving, for many chemists doubt whether a true solution takes place. At any rate, when paper, cotton-wool, and similar celluloidal substances are digested in such solution they disappear, and whether they are actually dissolved, or simply gelatinised and diffused through the liquid, is of little practical moment. In fact, the discovery itself, like so many others, was for a long time simply an interesting laboratory experiment. Scientific chemists were assailed with the usual, "Oh! very pretty, no doubt, but what is the use of it?" and had no reply till an ingenious chemist conceived the idea of taking canvas, paper, etc., through the solution at such a rate as to simply gelatinise the exterior of the fibres without disintegrating them, by which means, on subsequent drying, the film of gelatinised cellulose would be converted into an elastic varnish in which the copper would be taken up in the form of cuprocellulose, thus rendering the article perfectly proof against water, rot, or mildew. The above process, with such modification as experience has suggested, has been for some time worked on a commercial scale by the Waterproof Paper Company, Willesden, and the verb to Willesdenise has found ready acceptance in this connection. The Willesden goods are broadly divisible into two general classes: (1) Round or made-up goods, such as cordage; and (2) flat goods turned out in the roll. Goods of the first class are simply dipped into a bath of the solution, the strength of which and the period of immersion varying according to the article. In addition to the water-resisting, etc., properties thus conferred, it is also found that the treatment adds to the strength of the material by more or less cementing the fibres together. Goods of the second class form by far the more important section, and are subdivided into canvas, screen, and paper. Of the two former little need be said, the treatment being but little different from that described above, except the goods are usually unwound from one roll, pass successively through the bath and a series of drying rolls, and are finally rewound on to another. Coming now to Willesden paper, this is either welded or unwelded, the former being simply a roll of paper, treated as above, and applicable to innumerable useful purposes, as waterproof packing paper, lining for damp walls, waterproof stationery, etc. Welded Willesden paper is formed by simply pressing one or more layers of the unwelded while still superficially gelatinised by the action of the solution into one compact solid sheet or panel of indefinite length. These sheets may be of any desired thickness, and are known as 2-ply, 4-ply, and 8-ply respectively, from the thicknesses most in use. For 2-ply, two rolls of materials, either alike or dissimilar (say two of paper, or one paper and one calico), are simultaneously passed through the bath, and then pressed and dried as a whole. Two rolls of 2-ply passed through the bath a second time, pressed together, and dried form 4-ply; while two rolls of 4-ply similarly treated produce the 8-ply. The 2-ply is mostly used as a floor covering, and it has been found to wear fully as well as kamptulicon, linoleum, and similar preparations while immensely cheaper. It is also found to serve a useful purpose for laying on or under floor boards as a damp and draught excluder, as also as a packing, for damp walls and leaky roofs, and for internal decoration; 4-ply has come into extensive use as a building material, especially in cases where a combination in the same material of strength, lightness, and flexibility is a prime consideration. Another strong point in its favour is that, being entirely weather-proof—neither damp, nor frost, nor tropical heat affecting it in the least—it requires no painting (though for decorative purposes it will take paint readily enough). It also possesses many advantages over galvanised iron. Being a comparatively poor conductor of heat, buildings thus constructed will be warmer in winter and cooler in summer than those constructed of iron, while being so much lighter, the cost of transit is correspondingly reduced; 8-ply is mostly used for panelling where extra strength is required, the entire absence of the slightest tendency to split or crack being not the least of the many advantages claimed for this material over ordinary panel boards. It is also strongly recommended as a material for boat and ship-building, as vessels thus constructed would be both light and very easy to repair. I should, therefore, imagine that this is just the material you require, and could readily be obtained with such further information and advice as might be necessary from the company named. Unless for the sake of the experience to be thus acquired, I do not think it would be worth your while to experiment personally, as so much nicety is required in adjusting the strength of solution, timing the duration of immersion, etc., to say nothing of the presumed absence of suitable appliances. The cuprammonium hydroxide solution is made by the action of strong ammonia on copper turnings in a current of air. It was early suggested that the corresponding zinc compound (zinc-ammonium hydroxide) might be substituted for the above, but its action was found to be both too slow and too feeble to make it capable of replacing the other with advantage. Inasmuch, however, as the presence of zinc in the finished product would, in some cases, be desirable, further experiments were made, and it was found that by combining the two solutions, or, better still, by making a compound solution (using brass turnings instead of copper), some advantages were gained, zinc-copper cellulose instead of simple copper cellulose being thus secured. Of course, there are other forms of artificial wood known and in use, and one of these I will now mention. This process, though invented fully twenty years ago, has only comparatively recently come into extensive use. It consists simply in mixing very fine sawdust with bullock's blood (whence its name "hæmosite"), and submitting the same to hydraulic pressure. A great variety of articles having all the appearance of the most beautiful ebony carvings can thus be pressed in strong suitable moulds. Quite recently I learn the process has been utilised in the manufacture of brushes. The hair is set into the paste while still soft. This is then covered with the perforated plate to permit the passage of the hair; pressure is now applied, whereby brushes of one piece are formed, which are more durable and cheaper than those produced by the old process. The composition is also largely used for the production of door knobs and smaller articles.—P. W. S.

Cutting Mounts.—R. H. (*Lancaster*).—In cutting mounts the professional man depends upon a steady hand and sharp eye for cutting ovals, domes, or any fancy shapes, and usually keeps an assortment of his old centres for marking out new ones. See answer in "Shop," August 10th, page 333, for cutting square mounts. The plan illustrated cost sixpence. To mark an oval, the following is always the way a professional mount cutter proceeds: Trim your board upon which the mount



Mode of Drawing Ovals for Mounts.

is to be cut square, as marked in accompanying diagram. Draw a line across the centre, from E to F, then take the dividing compasses at half the width of your oval required, and place pin leg in centre, and mark width, H and I. Then measure your compasses half the length, and place pin leg in point H, and draw half circle, and again pin leg at point I, and draw again. Knock pins or wire nails in points where lines cross K and L and H, tie a piece of cotton tight round the three nails, withdraw nail H, and place your lead pencil in its place. Keeping it perpendicular, draw the line at full stretch of the cotton, and the oval is struck. Withdraw pins or nails, and proceed to cut round pencil line.—G. R.

Generation of Electricity in Dynamos.—J. H. H. (*Rochdale*).—You know, of course, that the armature of a dynamo is whirled rapidly round in the field of two electro-magnets. The iron in those magnets have some residual magnetism—that is, permanent magnetism remaining in them. As the armature revolves, the coils of wire with which it is wound cut across the lines of magnetic force, which always extend from one pole of one magnet to the other pole of the other magnet. This action on the part of the armature in the field of magnetic force induces a current of electricity in the coil of wire wound on the armature, which is communicated by the brushes to the outer circuit of the machine. Space cannot be spared in "Shop" to fully describe and illustrate "the passage of the current through helix and magnets," but you will find it fully described and illustrated in Parts 4, 5, and 6 of "Electricity in the Service of Man," now being issued by the publishers of WORK. A volt is the unit measure of electromotive force given by the current from one standard Daniell cell. An ohm is the unit measure of resistance given to the passage of an electric current by a 10 feet length of ·01 inch copper wire of 95 per cent. conductivity, or any other piece of wire offering an equal resistance. An ampère is the unit measure of current volume. It is that volume of current which will liberate ·00159 grains of hydrogen per second, or the equivalent proportion of any other substance in the same time. For full information on this subject, see my "Notes for Electro-Platers," section on ampères, page 130. You will learn much by the study of Professor Thompson's book on "Dynamo-Electric Machinery," and also "Electricity in the Service of Man," just mentioned. Shall be pleased to help you with advice at any time.—G. E. B.

Bronzers' Manual.—J. W. V. T. (*Frome*).—I do not think such a work as you mention is published in this country. Paris being the seat of a vast industry of bronze and other fancy metal ornaments, would naturally furnish the demand for it, since, I take it, the work you know of would refer to the bronze metal and not the imitation work. Concerning the latter, I am pleased to be able to help you, having at one time expended much pains and time in collecting and bronzing a collection of uncommon plaster cameos, busts, etc. All colours of bronze can be purchased in powder form or in solution under various makers' names, of methylated spirits and shellac, or spirits of salts, etc. If bought in liquid form they are applied with a suitable brush. The effect of this kind of liquid bronze is but second rate, so I advise you to purchase the powder from a dealer in gilders' material, and one who has a large and varied assortment of dry bronzes for you to select from. As the subject of gilding and bronzing will be thoroughly treated in WORK, I will ask you to be content with a few brief instructions. Well dust your plaster castings, and then give two successive coats of strong patent size; when thoroughly dry and hard give a coat of hard-drying copal varnish, and when this again is hard another good coat. This last coat we rub the powder bronze on to, using a little piece of new wash leather. Apply the bronzes when there is a good amount of tack—that is, stickiness—upon the varnish, but the surface must be comparatively dry and not at all soft. Some fine effects of imitation copper and dark green bronzes can be made by bronzing the article all over with gold bronze. When hard give a thin coat of varnish, and after paint it with a mixture of varnish and bronze green or copper paint, wiping the paint off the raised parts with rag, which show the gold through the paint. Bronze powders are best protected by a last cast over of copal varnish. There are numberless methods of getting fine imitations by the use of gilding and transparent lacquers, but these must wait for the present. "Shop" is developing so rapidly that the space is becoming most valuable. Shall be pleased to help you later on if desired.—F. P.

Castings for Ornamental Slide Rest.—'ARRY.—Apply to E. Hines, Griffin Works, Norwich.—F. A. M.

Sand for Brass Casting.—'ARRY.—I believe the best sand for amateurs is obtainable from dealers in dentists' appliances.—F. A. M.

Boat Building.—BOAT.—I quite agree with you that papers on boat building will be generally acceptable. There is so much, however, in hand that they cannot be commenced in the present volume, though if any of the promised single papers on canoe building, etc., reach me, they shall appear.

Copy from Fretwork Pattern.—TO THE BITTER END.—If you want to avoid the trouble of tracing your copy from pattern, which, I presume, is printed, you cannot do better than adopt the cyanotype or blue printing process of photography. This you will find fully described in No. 13 of WORK. A still simpler plan is to sensitise the paper with a solution of bichromate of potash, instead of the chemicals used in the blue process, though the resulting prints (the copies which are brown) are not so distinct. In either case the copy will be got more quickly by oiling the pattern so as to render the paper less opaque. When you have a piece of fretwork to copy from, I suppose you are aware the simplest plan is to take a rubbing from it with heelball.—D. A.

Lawn Mowers, Sharpening of.—J. S. (*Spilsby*).—Lawn mowers on the Archimedean principle may be sharpened by reversing the direction of the blades and applying very fine emery powder and oil. There is a small iron handle, usually supplied with each machine, which screws into one of the driving wheels, and by which the reversed motion is imparted to the cutters. The spiral blades are set as closely as possible to the fixed horizontal blade, along which the emery and oil is smeared, and the blades are then made to revolve as quickly as possible. You ask how to "grind and set" a lawn mower "by hand?" This is, as you say, sometimes attempted by unskilled workmen with the invariable result, which you also point out, that "lots of lawn mowers are spoiled." The fact is that it is impossible to grind spiral cutters true without the aid of machinery.—OPIFEX.

Inlaying.—H. G. W. (*Bridgwater*).—The centre ovals for inlaying, of which you send sketch, are made of veneers. The coloured pieces are white wood dyed through their entire thickness, while the lighter pieces are of box or some other light wood, shaded with hot sand. Veneers ready dyed are to be had from such people as D. Witt & Palmer, Drummond Street, Euston Square, N.W., much better and at less cost than you can prepare them for yourself in small quantities. Each piece, whether plain, shaded, or dyed, must be accurately

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cut to fit the position it is to occupy, either by fret saw or other means, straight edges being shot true. To shade, take a pan or dish containing sand, which must be heated sufficiently to brown any wood put into it. Care must be taken not to make the sand so hot as to char or burn the wood. Put the edge of the piece to be shaded into the sand, carefully watching the effect produced, and continue doing so till the desired tint is obtained. Though not difficult to manage after a fashion, care is necessary to get the gradations equal. When all the pieces are ready, glue them either direct on the work they are to ornament, or adopt the usual course of gluing them down on a piece of paper along with the surrounding veneer. The whole can then be laid in one piece with the paper, which is afterwards to be removed, uppermost. Before laying the veneer, but after the glued paper has dried, go over it on the uncovered side with a toothed plane or file to remove inequalities in thickness, and to slightly roughen the surface. Lay with a caul. Any fret saw will do for cutting inlays. Marquetry cutters generally make their own saws, but you will probably find it more convenient to buy them ready made. You will find a No. 2 blade do very well, but you may use either much coarser or finer if you prefer for such work as the centres you refer to.—D. A.

Bevelled Ends of Wash-Tub.—J. G. (*Glasgow*).—To bevel the ends of a wash-tub without first bevelling the top and bottom edges, all that is necessary to be done is to bevel the edges of the blade of bevel as described on page 173, to the same angle as you have decided to splay your sides, and mark your joints on the square edges of same in that direction (Fig. 1), fixing the blade of the bevel blade square across the stock, as the butt joint would be square if the sides of the tub were upright and not splayed. A good way to thoroughly understand this would be to bevel an edge of a waste piece of stuff to the angle or splay determined, and mark on the face the splay, and on the edge the bevel of butt joint (given by above bevel). Then make a saw cut down about ¾ of an inch. If you now plane the bevelled edge down square again and apply the bevel, you will at once see what I mean. Should you find any difficulty in determining the splay of your sides you will find a simple method given on page 414, but I have generally found in practice that it is more important to work to a certain width of stuff without jointing. For example, let us suppose you want to make a washing-tub, and you have some pieces of stuff that will work, say, 14 in. wide and 1 in. thick when planed up; all that you have to do is make a mark across the width of stuff to any angle, bearing in mind that the nearer the angle is to 90° the deeper the tub will be when finished. If the depth is not of much consequence, this is the right line to cut to without any further trouble, whether the edges are square or bevelled (Fig. 3).

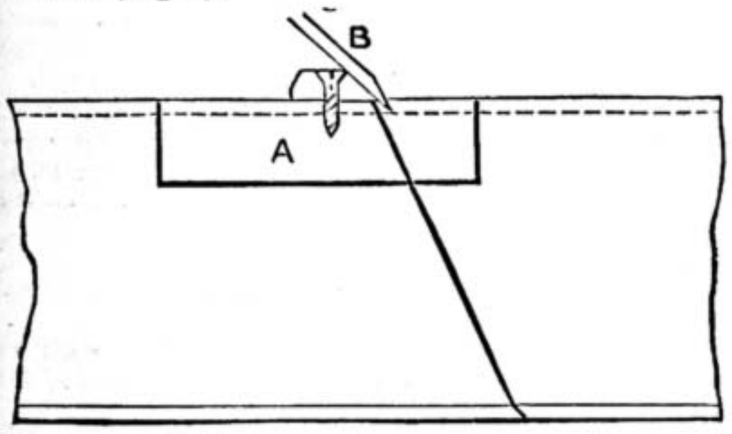


Fig. 1.

Fig. 2.

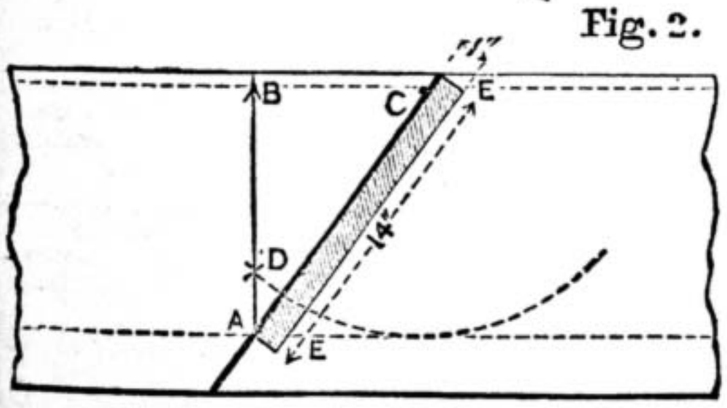
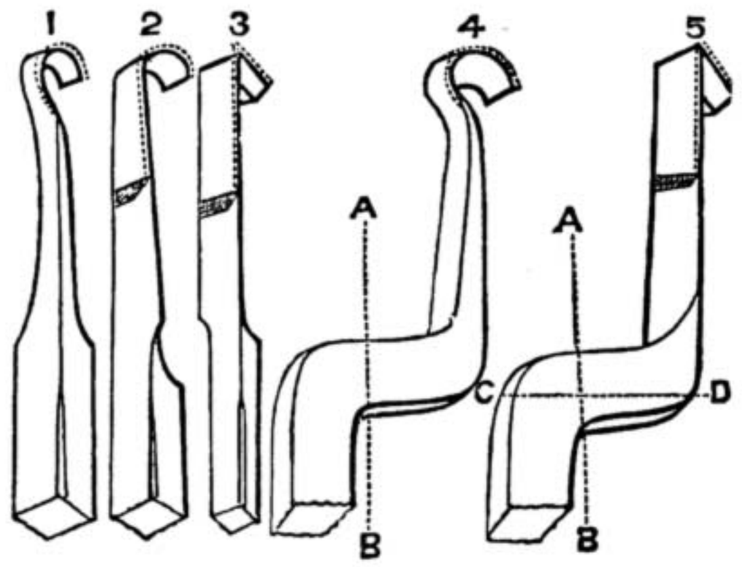


Fig. 3.

Bevelled Ends of Wash-Tub.

Should you wish to know how deep the tub would be if cut to this angle, you can easily find out by setting off the width and thickness of your stuff on this line (hatched on diagram), then mark off the two dotted lines, which will indicate the width the sides would be if the top and bottom were bevelled. Now square a line across the board from A to B, and from C, with width of board (which we will assume is bevelled) as radius, describe an arc, cutting A B in D; B D will then be the depth inside if the edges were bevelled. Should they not be bevelled it would be as much deeper as the stuff E E you do not plane off, and, if a line were drawn from D to C, that would give the bevel in elevation as explained by B. A. B., page 414; but I always endeavour, if possible, to keep away from elevations, etc., of oblique lines, as they are apt to be confusing, especially in connection with wash-tubs.—E. D.

Turning Inside Work in Soft Wood and Polishing Ivory.—TYRO (*Liverpool*).—You can, of course, turn your soft wood boxes inside with gouge and chisel, but if you want to make tooth-powder boxes by the score you will require hook tools, and must learn to use them. The chisel scrapes inside work, which answers perfectly for hard woods such as box-wood, but tears and leaves a rough surface in soft wood, requiring sand-paper to finish. The hook tools, Figs. 1, 2, 3, 4, 5, which are traced from the fourth volume of Holtzapffel's work on Turning, will cut and not scrape an inside surface, and the work is done with rapidity and smoothness. I have put dots round the cutting edge to distinguish it. Figs. 1, 2, and 4 act as gouges, Figs. 3 and 5 as chisels for flat surfaces, and these two last have an angle which is a little less than a right angle, and is very difficult to keep



Hook-Turning Tools.

quite sharp. Figs. 4 and 5 are called cranked tools; they can be used with the cranked part lying on the rest turned across the lathe-bed (as usual in inside work) along the line C D, which steadies and prevents their catching in; or they can be laid on the rest while it is still parallel with the bed along the lines A B, so that the hollowing can be done without even stopping to turn the top of the rest round. No. 1 costs 3s. 6d., and No. 3 costs 4s. 6d. from Holtzapffel. Ivory is scratched with sand-paper, and it may be turned extremely smooth with a sharp tool; if you must use sand-paper rub together two pieces of the finest grade before using them on the work, or you can use Dutch rush. To polish, make a cream of washed whiting, and apply it with a rubber of folded rag, moving it about to avoid marking the work with rings.—F. A. M.

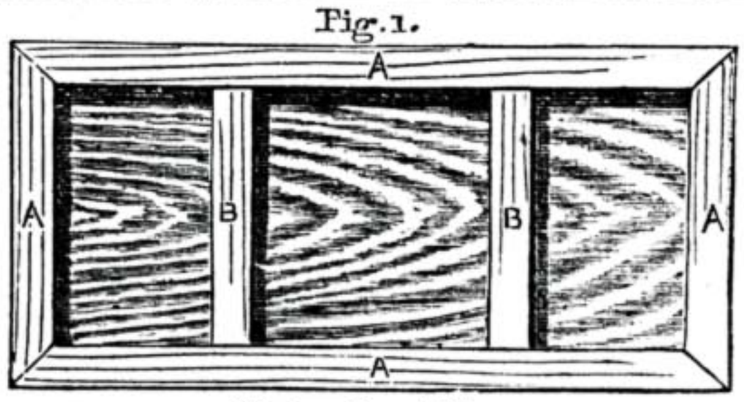
Polishing Fretwork.—N. M. (*Norwich*).—Do not be discouraged at your partial want of success in getting a fine bright polish on your fretwork, for the spiriting off is the most difficult part of the process. To manage it properly requires practice. You are probably correct in supposing that the cause of the polish being rubbed off is the use of too much spirit when "spiriting off." You should have the spirit rubber just moist enough to soften the surface of the shellac, and so remove the previous rubber marks. By having an excess of spirit in the rubber, you, of course, dissolve too much of the shellac, which is thus washed away. "Briskly" is hardly the way to apply the spirit rubber, as it rather implies that you have scrubbed too hard. Try an equable gentle movement, with what I may almost call a dainty touch, and by exercising your powers of observation, of which you are not deficient, you will soon note an improvement. Do you know that you should use a clean rubber for spiriting, and not the one you have bodied in with? Yes, you can move the rubber in any direction. Suppose you were to try glazing instead of spiriting. It is much quicker and simpler, and does well enough on fretwork, which, as a rule, is not subject to the wear and tear of ordinary furniture. As you are not an experienced polisher, you will probably get better results than by the superior method of legitimate French polishing. Now for the planing problem which you submit. With a fine set plane you should be able to smooth the edge of the board from whichever end you start, but it is almost impossible to say that this could always be done. A little "dodging" is sometimes necessary, and an experienced person would manipulate according to circumstances—in fact, it is just in cases of this sort that experience is most valuable, by showing when departure from a general rule is advisable, and may be practised with benefit. The jack is not the best plane for you to have used. The trying plane would have been better. If you have not got one of these, you might have managed with a smoothing plane, though, as this is short, very likely you would have experienced a difficulty in getting the edge perfectly straight. Don't think you are troubling. It is a pleasure to assist any one who evidently uses his brains along with his fingers and tools.—D. A.

Oak Stain for Pine Bookcase.—H. M. (*Glasgow*).—It is impossible to answer questions in the "first issue" after receipt, as the pages are made up some time in advance, that the enormous number of copies of WORK may be printed and ready for publication by the date they bear. Hence the reason for answer to your query not having appeared ere now. You do not say whether you want a light or dark oak colour to your bookcase, but the following mixture allows of great latitude in shade as well as in actual colour, according to the quantity of water: Vandyke brown mixed with liquid ammonia, and then diluted with water, a little Bismarck brown being added to give the reddish tint required. Another good stain may be made by dissolving bichromate of potash in water, and adding some of Stephens' walnut stain to reduce the orange colour of the bichromate. If the putty which you have used to fill up (a bad plan) shows too prominently, paint it over with the stain till it corresponds with the wood.—D. A.

Ebonising and Polishing Picture Frames.—CHEMICUS (*Hammersmith*).—It will be better for you to buy a black stain ready prepared. You can get this from any oilshop where polish is sold, and it is not only more economical but more satisfactory to do so. If, however, you prefer to make your own stain, here is a recipe. Boil some log-wood chips in the proportion of, say, ½ lb. to a pint of water, till all the colour is extracted. Apply the decoction to the wood, and when dry wash over with iron liquor made with steel filings, or scraps and vinegar. This turns the wood black, and when dry it is ready for French polishing in the usual way, which, I presume, you are acquainted with. Very likely the grain of the wood has been raised by the moisture of the stain. It should be rubbed down with very fine glass-paper till the surface is quite smooth again. As you do not say what wood your frames are of, I am unable to particularise on the details of polishing, but assuming this to have been done, and that a dull or dead black is wanted, the gloss is removed by emery or pumice powder dusted over with a brush or soft rag. For ebonising it is better, especially if the stain is not intensely black, to blacken the polish by mixing some gas black in it. This, however, is not always considered necessary, though it is a safe plan to adopt. The black polish should be strained before using.—D. A.

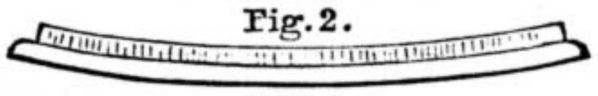
Warping of Table Top.—SOMERSET.—The cause of your table top having warped is very evident, and the lesson to be learned from it is so important that, for the benefit of other amateurs, I answer you as fully as the limits of "Shop" will allow. For the benefit of others the case is stated. A table top ⅜ in. thick is lined up to 1 in. In addition to the framing, A, stretchers, B, were placed across, glue being used to fasten these and the frame to the top, the underside of which is represented in the diagram (Fig. 1). The top has warped, as shown in Fig. 2, "appearing as if the stretchers had expanded lengthways," and you cannot imagine the reason, as the wood was thoroughly well seasoned. The whole secret consists in your having glued the end pieces of the lining and the stretchers to the top. The wonder to a practical cabinet maker would have been for the top to have remained flat under such circumstances. The grain of these pieces is directly contrary to that of the top. As you surmise, they cannot expand lengthways, nor can they contract in the same direction. They remain of definite length. The table top, however, has contracted in width, and being bound across over its whole width, instead of splitting, as it would have done had it been merely fastened to ends of the pieces referred to, it has simply curved in the direction it has. I presume you have not read the articles on "Lining up," and "Lessons from an Old Bureau," which have appeared in our pages, and I should

Fig. 1.



Underside of Top.

Fig. 2.



FRAME.

Warping of Table Top—A, Frame; B, Stretchers. All Glued on.

strongly advise you and other amateur cabinet makers to do so. Had you studied them before you made your table, you would have avoided the error, by no means a common one among amateurs, into which you have fallen. If you bind wood

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across the grain by transverse pieces, with the grain running in the contrary direction, one of two things is almost sure to happen. Either the wood will warp, as in your case, or split. If you had done as directed in the articles on lining up, screwed the ends of the frames and cross stretchers, leaving the screw necks loose, probably no such disaster would have happened. As the lining extends all round you should, even with screws, have cut the transverse pieces a trifle short—not much; $\frac{1}{16}$th would have been ample, for you can easily see that were they to fit tightly within the longer parts of the frame, the natural play of the top would be prevented almost as much as by glue, the chief difference being that it would probably have split instead of warping. If you preferred to use glue, you could have done so with safety by having the grain of the lining and stretchers in the same direction as that of the top. Look at the leaf of any good dining-table, and you will find the lining is glued on in this direction. You do not say the size of your table top, but as you say it is only small, I think you might safely dispense with the stretchers, B, unless the legs are fitted into them, in which case you can use screws to attach the top, as their grain will then naturally run across. The end linings will be better glued on, of course with grain coincident with that of the top. I trust I have made the cause of warping clear not only to yourself, but to others who may have met with similar mishaps, and I shall be glad to hear how you get on.—D. A.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Californian Red Wood.—REDWOOD asks:—"Having just fitted up a room with Californian red wood, which looks beautiful and neither requires paint nor varnish to improve it, I am anxious to know from any reader if anything can be done to preserve the colour, which I find since mine was finished has faded in the houses of others where it has been for some years."

Railway Carriage Building.—R. C. C. (*Plaistow*) writes:—"I shall be glad to hear of the best published book on railway carriage and waggon building, with price."

Fairy Bells.—SUBSCRIBER (*Bristol*).—Sorry I cannot answer your question as to the "Interior of a Fairy Bell." Possibly some reader may like to give you information.—W. F.

Bell Metronome.—FIDDLER (*Glasgow*) writes:—"Would any kind reader please tell me how to make a metronome with bell?"

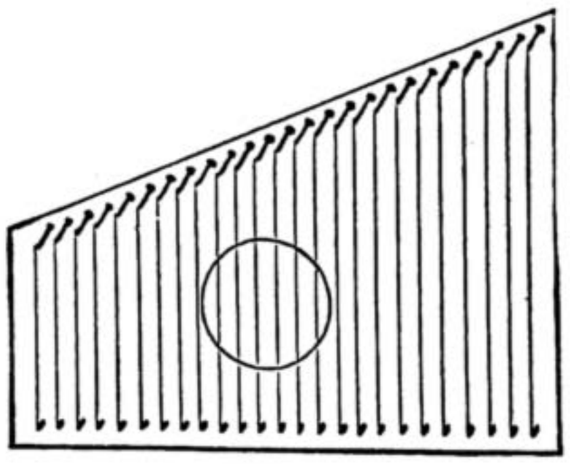
Chemistry Tests.—(*Cwmdn, Swansea*) writes:—"Please inform me through columns of 'Shop' if there is a book published 'Eggertz' Method Colour Tests for Chemistry'; where, and what price?"

Pitch of Roofs.—C. M. (*Hornsey Park Road*) writes:—"None of my building friends can really help me in this matter. When glassing the roof of a greenhouse or tiling a shed, I can only get an oracular 'That's too low,' or 'That's not high enough,' but none can give me any definite rule as to the necessary angle to be allowed. Will some of our WORK friends kindly help me in the matter?"

Tarring Fence.—C. M. (*Hornsey Park Road*) writes:—"Will some obliging subscriber to WORK tell me how to set to work on the above? What tar must I use, and how prepare it for use, and also how lay it on? Some of the tarring I see about remains wet for months, and gets half washed off by the rain."

Compressing Air.—DEALER (*Leeds*) writes:—"Would you or any of your staff be so kind as to give me dimensions of a simple arrangement for compressing air into small compass to last fifteen minutes or so with a gas blowpipe, instead of continual blowing by bellows or mouth?"

Zither.—J. D. (*Dublin*) writes:—"There was a cheap sort on sale here about three years ago (7s. 6d. each), but there are none to be seen in the shops now. They were in shape something like the following, and were stringed with wire. If you do



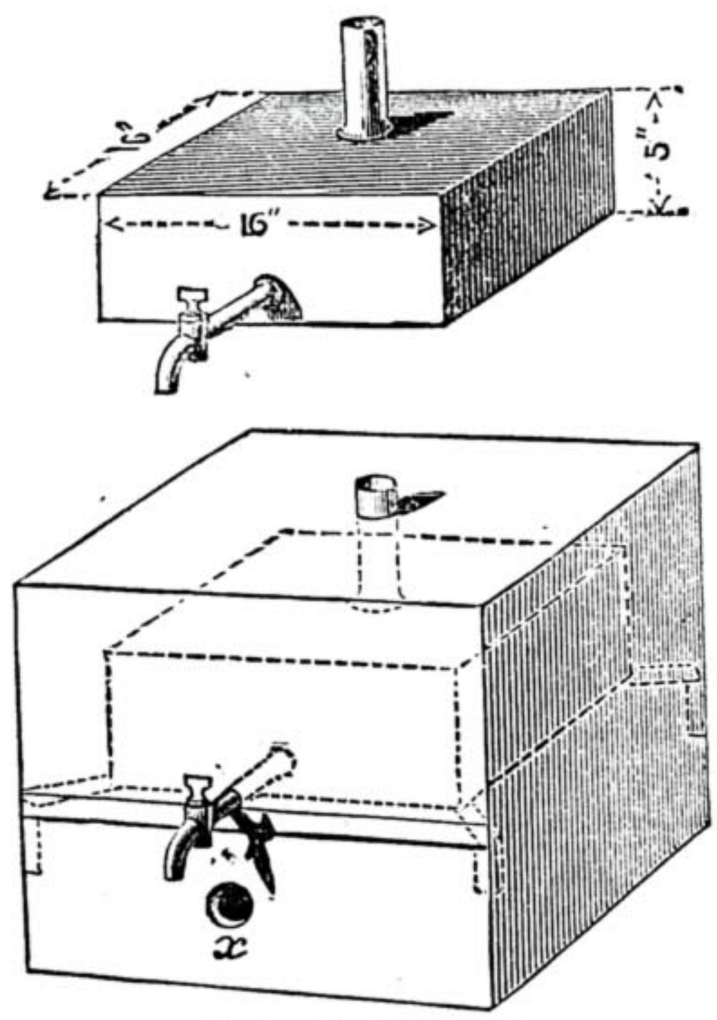
Zither.

not intend publishing a paper, perhaps you or some of your correspondents would let me know the proper angle at which to make frame with the length of strings, size of sound-holes, etc. By an early answer you will greatly oblige."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Tramcar Working Drawings.—X. Z. Y. writes:—"In reply to your correspondent J. W. F. (*Lancaster*), No. 33, page 526, working drawing of tramcar—Mr. J. J. Jones, 28, Uverdale Road, King's Road, Chelsea, S.W., will give him what information he requires."

A Simple Incubator.—J. T. R. (*Walker, near Newcastle-on-Tyne*) writes in reply to B. F. (*Liverpool*) (see page 302):—"Regarding plan for incubator of a simple construction, I beg to offer him a few suggestions derived from a very successful experience in the matter of hatching out. I am only afraid that the space allowed by the Editor for reply to his question will hardly suffice to explain all that is desirable as to the proper management of this interesting 'tin hen.' If permitted, I shall be pleased to give the readers of WORK the benefit of my experience at some future time, should the Editor deem the subject a suitable one for his all-round paper. First, the large tin box must be soldered tight. By this I mean there must not be any leak. If B. F. does not wish the incubator to cost him anything after he has it all made, he will adopt what may be termed the 'kettle of water' system, the heat being kept up by periodical fillings of hot water. Therefore the tank (tin box) will require a tube inserted on top, say, 1½ in. diameter and about 4 in. high. A tap will also be required at front, about 1 in. above bottom of tank, to project, say, 4½ in. Secondly, having proved the soundness of the tank, the outside casing may be made. This is a box built round tank, but 3 in. bigger at each side and top—viz., a 16 in. square tank will require casing to be 22 in. square. The height of the casing for tank of 5 in. depth would be 14 in., arrived at as follows:—3 in. for packing above tank, 5 in. depth of tank, and



A Simple Incubator.

6 in. depth of drawer. The tank may be supported by iron brackets screwed to sides of casing or a wooden shelf constructed to project 3¼ in. all round. Four ventilating tubes (¼ in. lead pipe does very well) should be placed one at each corner, to be bent under tank and project ½ in. above top of casing. A hole should be bored in bottom of casing at centre 2 in. diameter. Over this hole an article called a damper is placed. Anything will do that will hold water, and yet leave an open space in the centre across which to stretch a piece of cloth. The air coming in through this moist cloth gives the necessary dampness. Drawer must be made to clear the obstruction caused by this article. The drawer is without bottom, and is packed 3 in. at front with flocks. The best packing at the price is flocks, and the 3 in. space round tank and at top must be closely packed. There must also be 3 in. of packing at sides and back of drawer space, cased off. The front of drawer should be ½ in. bigger each way (length and breadth), and felt placed round the projecting edge. A thermometer is required to project into drawer, and be able to be withdrawn without having to open drawer. My experience is that tin is of little use, the water quickly making its way to the outside. Black iron, and the tank galvanised after made, is best. I keep the heat up without aid of kettle, running a tube through tank, and using a small lamp, which is kept burning. Heat as near 104 degrees as possible for good results."

Varnish for Drawings.—M. T. C. C. (*Carrickfergus*) writes in reply to A. M. (*Glasgow*) (see page 508):—"I think the varnish A. M. wants is clear paper varnish; it is the only varnish that I know that is almost colourless; but he must first size his drawings, or when he puts the varnish on they will turn almost black. Let him give his drawings two coats of glue size, then varnish, and all will be well. Varnish can be had from any oil and paint merchants."

Cleaning Engravings.—M. T. C. C. (*Carrickfergus*) writes in reply to IVOR (*Bradford*) (see page 494):—"Ordinary paint will not stand the action of lime. But most enamels will. Brunswick black and black japan stand the lime pretty well too, if allowed to dry hard."

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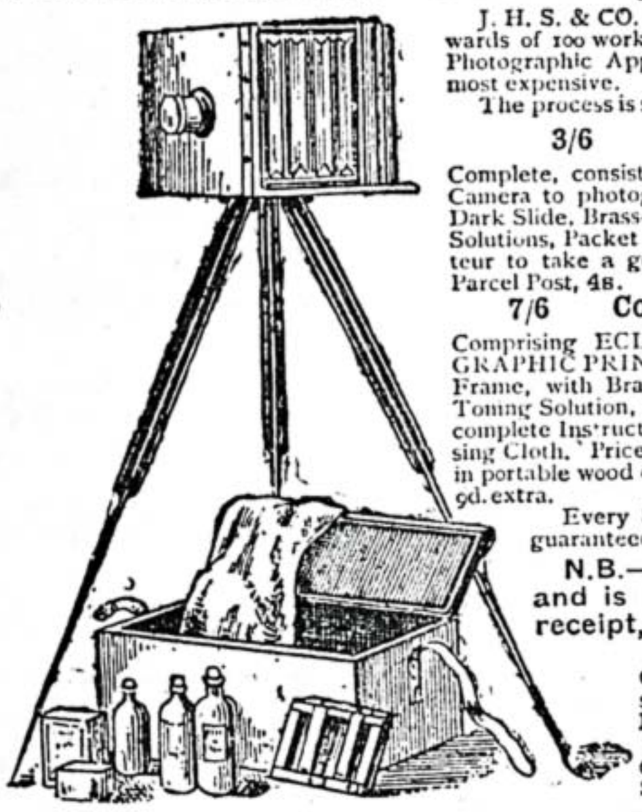

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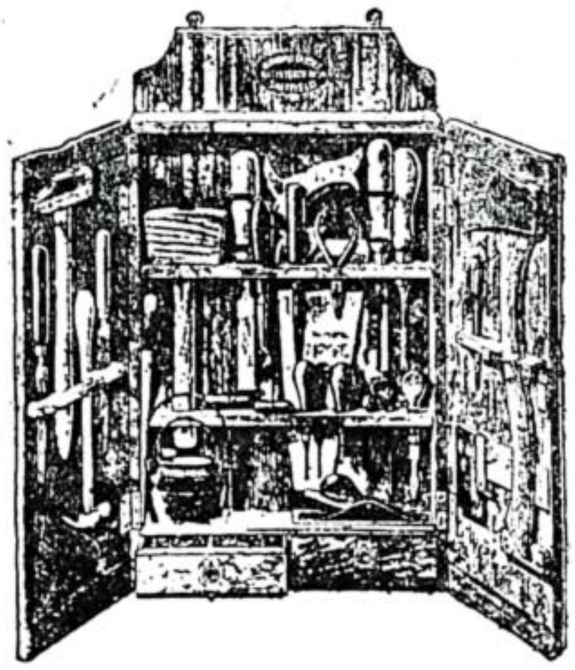

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